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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

AN EXAMINATION OF FOUR SUCCESSES IN THE COAST GUARD'S INNOVATION PROGRAM AND IMPLICATIONS FOR INNOVATION WITHIN HOMELAND SECURITY

by

Christopher Kluckhuhn

March 2008

Thesis Advisor:	Gail Thomas
Second Reader:	Christopher Bellavita

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Government bureaucracies designed to maintain a stable, fair, and open society are increasingly being outpaced by changing technologies, emerging threats, and shifting priorities. Innovation offers homeland security leaders an effective mechanism to sense emerging patterns, determine positive directions, and rapidly drive process improvements. This thesis examines literature related to leadership, strategic planning, collaboration, and government innovation. It highlights the importance of leadership and collaboration and illustrates how a relatively small number of people can drive significant change. A review of the U.S. Coast Guard's innovation program and four successful projects generated by that program is provided to demonstrate how the literature applies to homeland security agencies. An analysis of the projects identifies how leaders can act in concert to enable government innovation and drive significant capability enhancements and process improvements. Recommendations and conclusions stress the importance of integrating innovation programs with education and process improvement programs and ensuring efforts are aligned with overall agency direction. The thesis also offers recommendations about how the Department of Homeland Security can improve innovation within homeland security by supporting greater collaboration and information sharing between innovators across all homeland security fields.

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AN EXAMINATION OF FOUR SUCCESSES IN THE COAST GUARD'S INNOVATION PROGRAM AND IMPLICATIONS FOR INNOVATION WITHIN HOMELAND SECURITY

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Submitted in partial fulfillment of the
requirements for the degree of

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from the

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Government bureaucracies designed to maintain a stable, fair, and open society are increasingly being outpaced by changing technologies, emerging threats, and shifting priorities. Innovation offers homeland security leaders an effective mechanism to sense emerging patterns, determine positive directions, and rapidly drive process improvements. This thesis examines literature related to leadership, strategic planning, collaboration, and government innovation. It highlights the importance of leadership and collaboration and illustrates how a relatively small number of people can drive significant change. A review of the U.S. Coast Guard's innovation program and four successful projects generated by that program is provided to demonstrate how the literature applies to homeland security agencies. An analysis of the projects identifies how leaders can act in concert to enable government innovation and drive significant capability enhancements and process improvements. Recommendations and conclusions stress the importance of integrating innovation programs with education and process improvement programs and ensuring efforts are aligned with overall agency direction. The thesis also offers recommendations about how the Department of Homeland Security can improve innovation within homeland security by supporting greater collaboration and information sharing between innovators across all homeland security fields.

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I. INTRODUCTION

A. PROBLEM STATEMENT

The technological revolution, the emergence of terrorism as a principal threat, and the rapidly evolving international scene all combine to create a turbulent world. It is within this world of change that homeland security agencies struggle to understand, plan for, and respond to emerging threats and opportunities. Government bureaucracies designed to maintain a stable, fair, and open society are increasingly being outpaced by changing technologies and emerging trends. Our government needs to leverage all its resources to help make sense of emerging trends and respond accordingly.

The dynamic landscape makes it difficult for leaders to predict and plan for the future. Government planning and procurement processes, which often require years of advance work, lack the flexibility needed to adjust to rapidly emerging patterns. While government bureaucracy provides a needed stabilizing force to ensure fairness and order are maintained, the government needs process alternatives to better understand and adapt to our rapidly changing world. Traditional research and development programs are useful for understanding complicated issues, but they too require substantial lead time to start new projects and sometimes lack adequate feedback mechanisms to understand emerging patterns and directions. Our government requires better mechanisms to sense the emerging environment, test new ideas, and inform the body of government on favorable and unfavorable choices to pursue. While innovation programs are increasingly being used in the private sector to serve as that mechanism, innovating within the government poses unique challenges, requiring significant thought and purposeful direction to maximize effectiveness and minimize disruptions to government business processes.

B. RESEARCH GOAL

Innovation programs are increasingly being used to improve competitiveness and capabilities for public and private organizations. This research project traces how the

Coast Guard's internal innovation program created an environment that led to significant operational improvements in homeland security. The goal of this research paper is to identify critical success factors associated with four successful Coast Guard innovation projects. The results of the study will be used to suggest recommendations for innovation within the larger Department of Homeland Security.

C. PRACTICAL SIGNIFICANCE OF THE PROJECT

The research examines how the Coast Guard used innovation teams to complement its traditional R&D, procurement, and project management programs. It includes a review of relevant literature and a case study focused on the Coast Guard's innovation program. The research demonstrates the benefits of an internal innovation program, and will help the reader understand the building blocks and enablers needed for successful government innovation. The consumers of this research are the Coast Guard, the Department of Homeland Security, state and local government agencies, and private entities supporting government homeland security operations. The product of this research is an analysis followed by a set of recommendations to help leaders understand the dynamics behind successful government innovation, and to assist them in deciding whether to pursue an enterprise-wide, Department of Homeland Security (DHS) innovation program.

D. METHOD

The study begins by providing the reader with a background defining innovation and where its role is most useful. A literature review then helps the reader understand critical success factors associated with innovation. The review addresses leadership, strategic planning, collaboration, and government specific issues associated with innovation. The Coast Guard's innovation program and four individual innovation projects are then be documented in a case study to tangibly illustrate concepts discussed in the background and literature review sections.

To help overcome the challenge of documenting some of the invisible aspects of the innovation projects highlighted in the case study, a participant observer methodology

is used. Innovation is an enigma to many outside observers of the innovation process, who often fail to see synergies that may occur over years or decades of collaboration and quiet effort. Anthropologists studying foreign cultures and practices developed the participant observer methodology to gain a better understanding of cultural dynamics by embedding themselves in cultures over prolonged time periods. They have found that by becoming participants in the culture they are able to gain insights that would otherwise be unapparent to outside observers.[1] This thesis uses the participant observer methodology over a seven-year period to research the four selected innovation projects in the study. This method allows the reader to see some of the invisible factors associated with the innovation projects that would be difficult to identify using other research methods.

An analysis of the case study identifies common factors associated with each innovation project, and attempts to determine the most important building blocks and enablers associated with the innovations. Each innovation project is analyzed against the critical success factors detailed through the literature review. Finally, conclusions and recommendations are offered based on a thorough analysis of all the research.

[1] Stephen L. Schensul, Jean J. Schensul, and Margaret D. LeCompte, *Essential Ethnographic Methods: Observations, Interviews, and Questionnaires*, book 2, *Ethnographer's Toolkit* (Walnut Creek, CA: AltaMira Press, 1999).

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II. BACKGROUND

A. INNOVATION DEFINED

Literature and common language often use the term "innovation" interchangeably with other terms such as "invention." While innovation and invention overlap significantly, innovation is a broader concept, which encompasses invention. Most authors on the subject of innovation choose to define it as broadly as possible. The definition used by the government of New Zealand, which will serve as this thesis's definition, provides a good encapsulation of what most of the literature conveys when it calls innovation:

> The creation, development and implementation of a new product, process or service, with the aim of improving efficiency, effectiveness or competitive advantage. Innovation may apply to products, services, manufacturing processes, managerial processes or the design of an organization.[2]

There are no formal bounds where innovation can emerge within an organization; however, there are specific areas where it is most useful and likely to occur. To help understand where innovation best fits, David Snowden's Cynefin framework, shown in Figure 1, is an excellent model. He and co-author Mary Boone explain the model's five domains in their recent *Harvard Business Review* article, "A Leader's Framework for Decision Making." The Cynefin model was designed to help understand how leaders make sense of the world they are operating in and respond appropriately.

[2] Digital Strategy, www.digitalstrategy.govt.nz/templates/Page 60.aspx (accessed January 20, 2008).

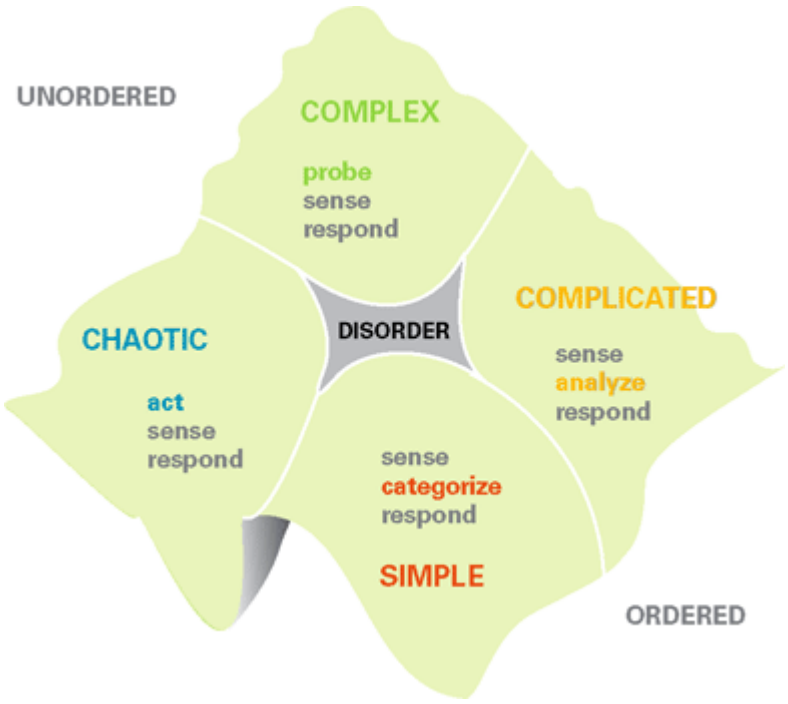

Figure 1. Cynefin Sensemaking framework: This illustration shows the four domains in each quadrant with disorder shown in the gap between domains.[3]

The model is composed of five domains. The chaotic and complex domains represent decision making in an unordered environment. The complicated and simple domains represent decision making in an ordered environment. When a leader is unable to determine the environment, Kurtz and Boone say they are temporarily in the domain of disorder.

In the unordered domain of chaos, where relationships between cause and effect are impossible to determine, the authors explain how small innovation teams can be used to complement a strong highly directed response by providing leaders and organizations opportunities to learn how to do things differently. One relevant example to demonstrate their point is the response to Hurricane Katrina. In addition to a directed response geared

[3] David J. Snowden and Mary E. Boone, "A Leader's Framework for Decision Making," *Harvard Business Review* (November 2007) http://harvardbusinessonline.hbsp.harvard.edu/hbsp/hbr/articles/article.jsp?OPERATION_TYPE=CHECK_COOKIE&referer=/hbsp/hbr/articles/article.jsp&productId=R0711C&TRUE=TRUE&reason=sessionAuthenticated&articleID=R0711C&FALSE=FALSE&pageNumber=1&ml_subscriber=true&_requestid=17866&ml_action=get-sidebar&ml_context=sidebar&ml_issueid=null&ml_id=R0711C&ml_sidebar_id=2 (accessed January 19, 2008).

toward saving lives and reestablishing order, numerous innovation teams were also employed to test new capabilities to improve communications and situational awareness for responders.

Snowden and Boone describe the unordered domain of complexity, where things can only be understood in retrospect, as a place for leaders to conduct experiments that are safe to fail. Doing so helps identify emerging patterns and allows experts in the ordered domain of the complicated to focus their energies on analyzing and responding to those patterns.[4] Since conducting experiments that are safe to fail is much of what innovation is considered to be about, the complex domain is where innovation fits best within this framework.

Once patterns have emerged from the unordered domains, the ordered domains of complicated and simple can be engaged more efficiently and effectively. Formal research and development programs best fit in to the complicated domain, where highly trained experts sense emergent patterns and thoroughly analyze them. When done in coordination with an innovation program, research and development resources can be directed more intelligently to support favorable emerging patterns and disrupt unfavorable patterns. After thorough analysis and refinement, most R&D entities have systems and processes in place to transition solutions to the simple domain where they can be thoroughly documented and systematized for simpler widespread adoption as well as greater efficiencies.[5]

B. COSTS AND BENEFITS OF INNOVATION

Successful innovations repeatedly demonstrate the power and benefits associated with innovation; however, there are costs associated with innovation that must be taken into account. Innovation requires time and monetary resources that appear inefficient; are sometimes disruptive to mainstream processes; and, often fail to produce tangible

[4] Snowden and Boone, "A Leader's Framework for Decision Making," 1-5.

[5] Snowden and Boone describe the domain of disorder as being where something exists when no other domain is predominant.

returns on investments through traditional accounting methods. The benefits generated by innovation programs are often undervalued because of the difficulty in tracking the short-term intangible and long-term tangible benefits.

In her article "The Cost of *Not* Innovating" Ruth Ann Hattori turns the cost-benefit argument around by asking what the cost in lost opportunities is from the lack of innovation.[6] She illustrates her point by showing the costs associated with non-innovative companies that are caught unprepared for emerging trends and customer requirements. Donald Sull also argues a similar point in his article "Strategy As Active Waiting," by describing the benefits derived from probing the future to open up "golden opportunities" and avoid "sudden death" events.[7] The 9/11 attacks provide a good homeland security example of the cost to our nation by failing to recognize a terrorist innovation and adapting to prevent it.

To demonstrate the benefits an end user-led innovation program can generate, the case study follows how the Coast Guard used $9.5 million in venture capital funds over a six-year period to generate process improvements valued at over $300 million by Coast Guard senior leaders. The case study also demonstrates how a loose innovation support structure created an environment where operational personnel were able to collaborate with support personnel to deliver capabilities that informed the organization and enhanced Coast Guard operational capabilities.

C. CURRENT INNOVATION EFFORTS WITHIN THE DEPARTMENT OF HOMELAND SECURITY

Within the Department of Homeland Security the Science and Technology (DHS S&T) Directorate has led innovation through formal R&D, university partnerships, and its externally focused Small Business Innovation Research programs. Despite the

---

[6] Ruth Ann Hattori, "The Cost of *Not* Innovating," *Heads Up! On Organizational Innovation,* May 2005, http://thinksmart.typepad.com/headsup_on_organizational/2005/05/what_is_the_cos.html (accessed December 22, 2007).

[7] Donald Sull, "Strategy as Active Waiting," http://harvardbusinessonline.hbsp.harvard.edu/hbsp/hbr/articles/article.jsp;jsessionid=GYEGFBE5W4MH2AKRGWDSELQBKE0YIISW?ml_action=get-article&articleID=R0509G&ml_page=1&ml_subscriber=true (accessed December 22, 2007).

significant, largely external innovation focus in science and technology, DHS has yet to develop a widespread innovation program designed to support internal field-level innovation across all homeland security disciplines. Within DHS, two component agencies have their own internal innovation programs that support collaboration and innovation by field level employees. One, the Transportation Security Administration's "Idea Factory," is an intranet site that allows employees to share ideas and generate online discussions about them.[8] The other, the Coast Guard's innovation program, will be the focus of this study.

[8] Federal Computer Week, FCW.com, http://www.fcw.com/print/13_42/features/150953-1.html (accessed January 26, 2008).

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III. LITERATURE REVIEW

The wealth of research conducted on the subject of innovation consistently identifies leadership, strategy, and collaboration as critical elements necessary for successful innovation. This literature review focuses on those three specific topics in detail. A comprehensive report focused specifically on identifying enablers and barriers associated with innovating in government is also included in this review, where many of the points discussed in the literature review are tangibly demonstrated in the case study. The analysis, discussion, and conclusions specifically draw on points highlighted in this section.

A. THREE CRITICAL SUCCESS FACTORS FOR INNOVATION

1. Leadership

Innovation begins with leaders who create vision and focus energy on the pursuit of their objectives. As you will see, innovation is driven by both formal and informal leadership at all levels of organizations. While formal processes and procedures designed to support innovation can be helpful, the research shows their specific structure is much less critical than leadership. Regardless of the processes in place, innovation leaders consistently demonstrate the ability to innovate successfully. They do this by working within existing organizational processes, maneuvering around unsupportive ones, and building more supportive environments for change within their organizations. Ideally, an innovative organization has leaders at all levels working in concert to do all three as needed.

Dr. Neal Thornberry, Director of Babson College's School of Executive Education and Chair of Innovation for the Naval Postgraduate School, focuses on innovative entrepreneurial leaders in his book *Lead Like an Entrepreneur.* Thornberry describes these types of leaders as individuals who have a bias for action and a good understanding of how to create value within their organizations through small gated

projects.[9] He goes on to explain entrepreneurial leaders are particularly good at creating a sense of urgency, generating short term wins and consolidating them to produce more change – three critical success factors that will be discussed in more detail later.

Thornberry uses the two by two matrix in Figure 2 to describe "activists" and "catalysts" working internally and externally to create value within the organization. He describes "activists" as leaders geared toward growing their organization or making it more efficient and effective.[10] Unlike activists, Thornberry explains that catalysts do not drive specific change but instead focus on creating the conditions necessary for innovation and entrepreneurism.[11] We will look at each role and their subsets in more detail below.

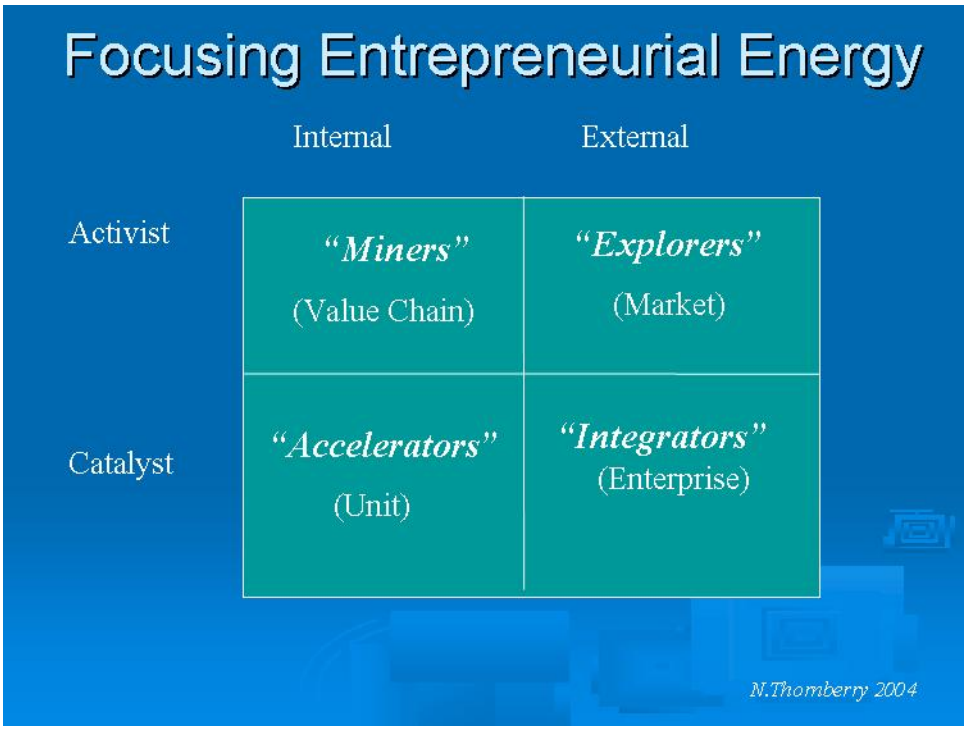

Figure 2. Focusing Entrepreneurial Energy.

[9] Neal Thornberry, *Lead Like an Entrepreneur* (McGraw-Hill, 2006).

[10] Ibid., 60.

[11] Ibid., 63.

According to Thornberry, activists have good intuition about how to persuade their organization to pursue particular directions without pushing their position so far that they are terminated. They can use an internal process improvement approach that Thornberry terms as "miners," or an external approach he terms as "explorers."[12] Thornberry explains that miners often exist one or two levels removed from frontline action and create value by focusing on improving the efficiency and effectiveness of existing processes. Explorers, on the other hand, create value by building new systems or processes in previously undeveloped or undefined areas. Thornberry points out that explorers are typically closer to the frontlines and are well-positioned to understand emerging markets or requirements.[13] He explains that explorers typically have a bias for action and are willing to spend the time and energy to research their ideas, develop a strong business case, and champion the initiative until it is successful. Explorers are the types of people we regularly associate with innovation because their projects and personalities often generate the most visibility.

Thornberry distinguishes between "catalysts" by classifying "accelerators" as internally focused and "integrators" as externally focused.[14] "Accelerators" typically lead a single unit or department in an organization and foster an innovative environment by encouraging risk taking and novel methods for accomplishing their work requirements. Accelerators create an empowered environment for employees by generating trust, providing stretch goals, and by providing a protective shield from outside destructive forces. As they gain seniority and increased responsibility, accelerators can become "integrators." Instead of focusing on a single unit, integrators generally have a broader scope of responsibility within an organization and focus on creating a structure that supports enterprise-wide innovation and entrepreneurship. An integrator has the ability to influence many different factors to help create an environment where resources, recognition, and senior support are available for the other three types of leaders to fully leverage.

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[12] Thornberry, *Lead Like an Entrepreneur*, 60-61.

[13] Ibid., 74.

[14] Ibid., 64.

One excellent example of both an accelerator and an integrator within the Coast Guard is Geoff Abbott, a retired Coast Guard Captain. While serving as a commanding officer at two field units, Abbott was an accelerator. He created an environment that allowed miners and explorers under him to create significant value for the Coast Guard. When he was promoted to a senior headquarters position, he became an integrator by coordinating several different initiatives into the Coast Guard's modern innovation program.

Based on his experience, Abbott wrote a tactical guide for implementing change in the government and the military called "Leading from the Middle."[15] He argues that regardless of rank, every leader must answer to someone and is therefore in a middle leadership position. His paper helps leaders from all organizational levels understand that they are able to lead change regardless of their position. Abbott shares thirty years of organizational wisdom by helping change leaders understand how to drive successful change without getting destroyed in the process.

Abbott's guide is geared toward government entrepreneurs Thornberry would classify as miners and explorers. Abbott stresses the costs and risks associated with change, and he encourages change leaders to weigh the benefits of action against the costs and risks from organizational as well as a personal perspectives. If after deciding a change is worth the effort, he says leaders should have the courage to go forward with the effort. He stresses the importance of partnering, flexibility, courage, and intelligent persistence. The concept of intelligent persistence is what Thornberry was referring to when discussing the successful activist's ability to push the organization without getting terminated in the process. Rather than pushing an initiative relentlessly, Abbott suggests being intelligent about when to apply energy. He recommends gaining a good understanding of budgetary cycles, strategic initiatives, and senior personalities before charging blindly forward with an initiative.

[15] Geoffrey Abbott, "A Guide for Leading Change 'from the Middle': You Can Make A Difference!," (Unpublished).

Abbott directly addresses leadership issues of trust and empowerment by discussing his "waterline" philosophy.[16] A hole below the waterline of a ship could potentially sink it, while one above the waterline is less of an immediate threat and is much easier to repair. By applying this philosophy to decisions regarding trust, Abbott argues that subordinates should be empowered to make any decision that does not risk the ship by causing holes below the waterline. He argues that the benefits of doing so are far greater than the consequences of a few holes above the waterline. Abbott stresses that along with this type of empowerment, accountability is needed. Employees should be allowed to make mistakes they can learn from, but it is critical that they do learn and are not allowed to continue making the same mistakes repeatedly.

Abbott also stresses the importance of finding enough resources to fuel a leader's change initiative. Abbott discusses the concept of "bootlegging," which encourages official – and sometimes unofficial – siphoning of resources to provide a change initiative the necessary resources to build critical mass.[17] He also stresses the importance of teamwork and forming partnerships to generate additional resources for the initiative. As a supporter of Total Quality Management and the National Baldridge Quality Program, Abbott stresses the importance of a systematic process improvement approach. Using a slight play on words, Abbott introduces the term "Team Quality Management" to highlight the importance of everyone working as a team to drive change improvements.

As a model for leading change from the middle, Abbott refers to Harvard Professor John Kotter's systematic change process outlined in his book *Leading Change*.[18] To improve the success of change efforts, Kotter outlines the following eight criteria: establish a sense of urgency, create a guiding coalition, develop vision and strategy, communicate the change vision, empower employees for broad-based action, generate short-term wins, consolidate gains and produce more change, and anchor new approaches in the culture. Three of these criteria - creating a sense of urgency, generating short-term wins, and consolidating gains to drive more change - were actions

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[16] On a ship, the waterline is where the hull emerges from the water.

[17] Ibid., 18.

[18] John P. Kotter, *Leading Change* (Boston: Harvard Business School Press, 1996), 33-145.

where Thornberry found leaders in his activist category excelled. The remaining five criteria are responsibilities he found leaders in the catalyst category performed well. These differing roles help us understand that successful change efforts frequently require collaboration between leaders to address all critical factors.

Leaders in the public sector are typically constrained by short times in their positions as well as bureaucratic and political constraints, which can make it more difficult to instill an innovative culture or lead change initiatives. In his article "Change Management in Government," Frank Ostroff outlines several principles that help public sector leaders drive successful public sector change management efforts.[19] Ostroff argues that most public leaders have eighteen to twenty-four "effective" months to manage change in their organizations, and must truly lead change rather than simply serving as bureaucrats.[20] Leaders can use their short management window to create the sense of urgency Kotter advocates, but to ensure success they also need to anchor their changes into the culture of their organization.[21] To do this, Ostroff suggests that leaders appeal to government employees' sense of mission by demonstrating how the changes improve the performance of their organization's core missions.[22] Like Kotter, Ostroff also recommends using a steering committee or a guiding coalition to support change efforts and help communicate the vision.

2. Strategy

Another key to successful innovation is good strategy and vision from leaders. Thornberry's catalysts, the integrators and accelerators within organizations, often develop long-term strategies geared toward building a culture of innovation. Catalysts are not focused on developing strategy for specific projects, but instead focus on creating the right environment for others, the activists in organizations, to develop successful

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[19] Frank Ostroff, "Change Management in Government," *Harvard Business Review*, (Boston, May 2006), http://harvardbusinessonline.hbsp.harvard.edu/hbsp/hbr/articles/article.jsp?ml_action=get-article&articleID=R0605J&ml_page=1&ml_subscriber=true (accessed January 20, 2007).

[20] Ibid., 2.

[21] Kotter, *Leading Change*, 145-158.

[22] Ostroff, "Change Management in Government," 10.

innovation strategies. By creating the right internal environment, catalysts improve their organization's ability to probe the external environment, sense future directions, and respond to them. Individual projects that probe the future and fail are often seen as successes by their organizations because of the sensory information they provide. Innovative organizations understand that to successfully sense the future, more projects providing sensory input leads to more information about what strategic actions will be most successful.

In his article "Strategy as Active Waiting," Donald Sull argues in favor of creating an innovative environment to plan strategically when there is significant uncertainty about the future environment.[23] Sull believes that it is impossible to divine the future in a rapidly-evolving world, and feels leaders are best served when they take action during lulls in activity to improve the efficiency of daily operations. By focusing on efficiency and effectiveness of present operations, Sull argues that organizations can use resources and time gained through process improvements to probe the environment for promising new directions he terms as "golden opportunities." As Ruth Ann Hattori also found, Sull warns that organizations that fail to probe and sense the future risk "sudden-death" events. He says these events occur when organizations fail to react properly to an evolving environment until the changes become so large that they are thrown into crisis when their future existence is threatened.

While numerous 20th century examples of corporations experiencing "sudden-death" events can be found, IBM's story powerfully illustrates the point. During the mid-1980s, IBM was listed by Fortune magazine as one of the most admired corporations four years in a row, but within a decade, they nearly collapsed due to their failure to sense the changing business landscape. By 1994, IBM had lost nearly 70% of its market cap to

[23] Donald N. Sull, "Strategy as Active Waiting," 120-129. http://harvardbusinessonline.hbsp.harvard.edu/hbrsa/en/hbrsaLogin.jhtml;jsessionid=4TIBF0Z2D01CQAKRGWCB5VQBKE0YOISW;$urlparam$kNRXE2ULYRiR52NiwJYH5SF?ID=R0509G&path=arc&pubDate=September2005&_requestid=9652 (accessed December 22, 2007).

other more innovative companies like Microsoft, Fujitsu, and Compaq.[24] After three years of losses totaling $15 billion, many people were calling for the company to be broken up and sold off.[25] Fortunately, for IBM, they were able to learn from their near "sudden death" experience. They have since embraced innovation and now devote a significant amount of their energy on fostering innovation and collaboration to identify future "golden opportunities."

An equal number of examples can be used to reinforce Sull's point about using down time to create "golden opportunities." One that will be discussed in the case study is a mapping program called FalconView, which began as a grass roots effort in the Air Force. In his MIT doctoral dissertation, "War upon the Map: The Politics of Military Innovation," Jon Lindsay shows how FalconView innovators created a "golden opportunity" for their innovation out of a "sudden death" event. During the early 1990s FalconView innovators leveraged improved personal computer capabilities to provide in-flight moving map and situational awareness capabilities equal to or superior to more expensive and formally approved Air Force systems. After an Air Force 737 jet carrying Commerce Secretary Brown crashed into a mountain in Croatia, investigators found that the crash might have been avoided had FalconView been in use aboard the flight.[26] Soon afterwards, FalconView was mandated for use aboard all Air Force distinguished visitor aircraft, including Air Force One.[27] FalconView's innovators had been working hard during a lull and were prepared with an operational product when a sudden event caused

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[24] Gary Hamel, "Waking Up IBM: How a Gang of Unlikely Rebels Transformed Big Blue," *Harvard Business* Review (July-August 2000) http://harvardbusinessonline.hbsp.harvard.edu/hbsp/hbr/articles/article.jsp?OPERATION_TYPE=CHECK_COOKIE&referer=/hbsp/hbr/articles/article.jsp&productId=R00406&TRUE=TRUE&reason=archive&FALSE=FALSE&ml_subscriber=true&_requestid=129300&ml_action=get-article&articleID=R00406&pageNumber=1 (accessed February 4, 2008).

[25] Gary Hamel, "Waking Up IBM: How a Gang of Unlikely Rebels Transformed Big Blue."

[26] Jon R. Lindsay, "War upon the Map: The Politics of Military Innovation" (draft thesis version 3.0, MIT, Department of Political Science, June 2006). http://www.mit.edu/~lindsayj/Projects/WarUponTheMap%20v30.pdf (accessed June 10, 2007).

[27] Lindsay, "War upon the Map," 32.

a need for it. As a result of their continued innovation and preparedness, Falconview has grown into a $30 million Department of Defense program of record used by more than 20,000 personnel.[28]

3. Collaboration

Collaboration is another key theme that is repeated throughout the research on innovation. Keith Sawyer's *Group Genius* focuses on the power of collaboration in creating new ideas and innovative solutions.[29] His book draws upon more than two hundred sources to argue the point that the heart of innovation is accomplished through collaboration, not geniuses with sudden visions. Sawyer identifies the following seven characteristics of creative and effective teams: innovation emerges over time; successful collaborative teams practice deep listening, team members build on their collaborators' ideas only afterwards does the meaning of each idea become clear, surprising questions emerge, innovation is inefficient, and innovation emerges from the bottom up.[30] To support his argument, Sawyer points to modern companies like W. L. Gore and Associates, 3M, Google, and IDEO who employ many of these characteristics in their operations.[31]

Sawyer rightly uses W. L. Gore and Associates as a prime example. Gore is the maker of Gore-Tex fabrics, Elixir guitar strings, and approximately 1,000 other products.[32] Prior to founding Gore and Associates, Bill Gore spent seventeen years working for DuPont. While there, he recognized two profound things about the times he and his associates were most creative and productive. He realized the best exchange of ideas took place in car pools where no hierarchy existed, and that when his company

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[28] FalconView was adopted by Coast Guard innovators and is one of the innovation projects highlighted in the case study.

[29] Keith Sawyer, *Group Genius* (Basic Books, 2007).

[30] Ibid., 14-17.

[31] Ibid., 18.

[32] Alan Deutschman, "The Fabric of Creativity," *Fast Company* Issue 89 (December 2004) http://www.fastcompany.com/magazine/89/open_gore.html (accessed December 27, 2007).

needed to address a crisis, they formed teams to respond.[33] Bill Gore decided to structure his company so that it maximized the benefits of both by creating teams without hierarchy and limiting their size to a maximum of two hundred people.

The result of W. L. Gore and Associates' collaborative approach is remarkable by any measure. In 2004, the company was named as the most innovative in America by *Fast Company* magazine.[34] In less than fifty years, their company has grown from a small home business into a worldwide force of approximately 8,000 employees, working in forty-five locations, producing more than $2 billion in annual sales.[35] It has also been consistently recognized as one of the best places in the world to work. Fortune Magazine included Gore for a tenth consecutive year in its annual list of the U.S. "100 Best Companies to Work For." For a fourth year in a row, Britain's Sunday Times ranked Gore first on its list of "100 Best Places to Work in the U.K.," and Gore was also ranked 2nd and 12th, respectively on similar lists in Germany and Italy in 2007.[36] The company points to their collaborative culture as the foundation for their innovative products and their success.

In his article "The Why, What, and How of Management Innovation," Gary Hamel supports Keith Sawyer's argument about the importance of collaboration.[37] Hamel explains why Toyota and Whole Foods Market have become more successful than their industry peers have by harnessing more of their employees' collective ability through the use of teams, and by empowering their employees to make decisions and innovate.[38] In the same article, he goes on to show how in 1968 a small team of collaborators developed and tested a credit card solution that addressed the challenge of

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[33] Deutschman, "The Fabric of Creativity."

[34] Ibid.

[35] W. L. Gore & Associates, Inc., http://www.gore.com/en_xx/aboutus/fastfacts/index.html (accessed December 27, 2007).

[36] Ibid.

[37] Gary Hamel, "The Why, What, and How of Management Innovation," *Harvard Business Review*, February 2006, http://harvardbusinessonline.hbsp.harvard.edu/hbsp/hbr/articles/article.jsp?ml_action=get-article&articleID=R0602C&ml_page=1&ml_subscriber=true (accessed December 27, 2007).

[38] Ibid.

balancing cooperation and competition between banks.[39] The team's leader, Dee Hock, drew on his knowledge of collaboration, Jeffersonian democracy, and nature to develop the following principles that the team followed to develop their solution:

- Power and function in the system must be distributed to the maximum degree possible.
- The system must be self-organizing.
- Governance must be distributed.
- The system must seamlessly blend both collaboration and competition.
- The system must be infinitely malleable, yet extremely durable.
- The system must be owned cooperatively and equitably.[40]

The result of their effort was the creation of Visa and the worldwide emergence of the credit card industry.

In another article, "The World Bank's Innovation Market," Gary Hamel and Robert Chapman Wood show how a small, relatively junior team at the World Bank collaborated to develop a better way to identify small start-up projects for funding.[41] During a day-long brain storming session, the group came up with the idea of a marketplace to share ideas.[42] Within three months of their initial meeting, the group had developed the "Innovation Marketplace," an event where anyone could come to present their ideas to World Bank leaders.[43] They decided to use $3 million of their annual $5 million budget to provide start up funds to the most worthy projects presented.[44] Before the group could implement their idea, internal organizational resistance to the idea threatened to derail it. Fortunately, senior leadership intervened to allow the innovative idea to be tested, and the World Bank held its first Innovation Marketplace in 1998 with

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[39] Hamel, "The Why, What, and How of Management Innovation," 8.

[40] Ibid., 8.

[41] Robert Chapman Wood and Gary Hamel, "The World Bank's Innovation Market," *Harvard Business Review*, November 2002, http://harvardbusinessonline.hbsp.harvard.edu/hbsp/hbr/articles/article.jsp?ml_action=get-article&articleID=R0211H&ml_page=1&ml_subscriber=true (accessed December 27, 2007).

[42] Ibid., 2.

[43] Ibid.

[44] Ibid.

120 bank employee booths making presentations.[45] In addition to financial support, the team also helped to foster a collaborative atmosphere through their "People's Choice" awards, which allowed the 2,000 attendees to place stickers next to their favorite booths.[46] Those booths with the most stickers were able to help generate additional buzz about their ideas by showing that others found their work compelling. Like Sawyer, Hamel and Chapman also describe the group genius that took place during the Innovation Marketplace as visitors and other presenters collaborated and rapidly permutated their ideas into more powerful innovations.[47]

Now known as the Development Marketplace, The World Bank's innovative solution has entered its tenth year and expanded globally. In addition to a bi-annual event held in Washington, D.C. and available to everyone, the World Bank now supports Development Marketplaces in countries around the world.[48] The Bank has awarded more than $46 million dollars to support approximately 1,000 early stage projects through its Innovation Marketplace mechanism.[49] It also devotes significant additional resources to support information sharing and collaboration among its participants.[50]

B. ENABLERS FOR AND BARRIERS TO INNOVATING IN THE FEDERAL GOVERNMENT

In his report "The Challenge of Innovating in Government," Sandford Borins, Professor of Public Management at the University of Toronto, explains how bureaucratic constraints, lack of reward incentives, and the potential for punishment all combine to

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[45] Wood and Hamel, "The World Bank's Innovation Market," 3.

[46] Ibid.

[47] Ibid.

[48] The World Bank, http://web.worldbank.org/WBSITE/EXTERNAL/OPPORTUNITIES/GRANTS/DEVMARKETPLACE/0,,contentMDK:21558214~menuPK:174568~pagePK:180691~piPK:174492~theSitePK:205098,00.html (accessed December 27, 2007).

[49] The World Bank, http://web.worldbank.org/WBSITE/EXTERNAL/OPPORTUNITIES/GRANTS/DEVMARKETPLACE/0,,contentMDK:21558309~menuPK:4115000~pagePK:180691~piPK:174492~theSitePK:205098,00.html (accessed December 27, 2007).

[50] Ibid.

impede innovation within government.[51] Despite those barriers to innovation within government, Borins found a large global data set of innovative government organizations on which to conduct research through the Harvard Kennedy School of Government's Ford Innovation Awards Program and the Commonwealth Association for Public Administration and Management's international innovation award competition.[52] Using data from both awards programs along with his own questionnaires, Borins was able to identify common enablers of and barriers to government innovation.[53]

1. Building Blocks and Enablers

Borins' research found that the majority of innovations in both the U.S. and British Commonwealth award programs were initiated by frontline workers or middle managers.[54] With the support of other research done by fellow innovation scholars Paul Light and Gary Hamel, Borins found that innovation emerges from lower levels of organizations due to greater diversity of personnel, greater familiarity with processes, and greater familiarity with new research and technologies. He argues that formal process improvement programs, such as Total Quality Management, serve as valuable conduits to provide lower level employees the ability to express innovative ideas and help make government agencies more innovative overall.[55]

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[51] Sandford Borins, "The Challenge of Innovating in Government," http://www.businessofgovernment.org/pdfs/BorinsReport.pdf (accessed January 26, 2008).

[52] The Commonwealth Association for Public Administration and Management international innovations award competition, held in 1998 and 2000, is open to public sector organizations throughout the Commonwealth. A questionnaire that is virtually identical to the Ford-KSG semifinalist questionnaire was sent to CAPAM applicants. The Commonwealth includes several economically advanced countries (Australia, Canada, New Zealand, Singapore, the UK) and many developing countries in the Caribbean, Africa, and Asia. This questionnaire yielded a total of 83 responses, 37 in 1998 and 46 in 2000. There were 56 responses from economically advanced countries, including Canada (20), Australia (15), Singapore (14), New Zealand (3), Malta (3), and the UK (1). There were 27 responses from developing countries, including India (8), Malaysia (6), South Africa (5), Jamaica (2), and individual responses from Bangladesh, Cyprus, Ghana, Iran, the Seychelles, and Zimbabwe. These questionnaires were coded in the same way as the Ford-KSG awards questionnaires.

[53] Borins, "The Challenge of Innovating in Government," 38.

[54] Ibid., 28.

[55] Ibid., 29.

Based on his extensive research, Borins identifies the following five key building blocks needed for innovation within government:

1. A systems approach
2. The use of new information technology
3. Process improvement
4. The involvement of the private or voluntary sectors
5. Empowerment of communities, citizens or staff[56]

He then outlines seven key enablers of innovation that public sector leaders can use to foster greater innovation within their organizations:

- An innovative culture needs support from the top. It can come in the form of establishing organizational priorities to guide innovation, recognition for innovators, protection of innovators from central agency constraints, and granting the latitude to experiment.
- Increased rewards to innovative individuals may include financial compensation, for example, performance-related pay and gain-sharing. Non-monetary awards recognition may be a motivating factor as well.
- Individual innovators made clear that lack of resources for innovations was a serious constraint. One response to this is to establish a central innovation fund to support innovative ideas within the public sector. Financial management reforms also create the possibility of enhanced internal funding for innovation within all agencies.
- Because innovation often depends on the ability to see things differently, diversity in terms of the backgrounds and ways of thinking of an organization's members will enhance its innovativeness.
- Innovative organizations are effective at seeking out information from the outside. Examples are benchmarking, making site visits, and participating in professional networks. They are also effective at sharing this information internally.
- Innovative organizations draw ideas from people at all levels.
- Innovative organizations are effective at experimenting and evaluating their experiments. They recognize that failures are possible, and have lowered the cost to their staff of honorable failures. They continue with their successes and discontinue their failures.[57]

[56] Borins, "The Challenge of Innovating in Government," 6.

[57] Ibid., 7.

Together, the five building blocks and seven enablers will be used as part of the analysis of the Coast Guard case study to determine to what extent each factored into the success of Coast Guard innovations.

2. Barriers

After analyzing more than 400 innovations in the U.S. and throughout the British Commonwealth, Borins identified nearly 900 obstacles to innovation.[58] He classified the obstacles into three categories: internal bureaucratic, political, and external. Figure 3 shows that internal bureaucratic resistance accounted for more than half of the obstacles to innovation. Overall, Borins found that the highest single barrier to innovation was lack of adequate resources. He found that the lowest barrier to innovation was internal opposition to employees acting entrepreneurially.

[58] Borins, "The Challenge of Innovating in Government," 19.

Table 2: Obstacles to Innovation

Obstacle	U.S. 1990-98, Occurrences	U.S., % of total	Commonwealth, Occurrences	Commonwealth, % of total
Bureaucratic attitudes	66	9.2	16	9.6
Turf fights	12	1.7	5	3.0
Other resistance	50	6.9	11	6.6
Total bureaucratic	**128**	**17.8**	**32**	**19.3**
Coordination problems	66	9.2	18	10.8
Logistics	66	9.2	24	14.5
Burnout	38	5.3	2	1.2
Implementing technology	39	5.4	15	9.0
Union opposition	13	1.8	5	3.0
Mid-mgt. opposition	11	1.5	4	2.4
Opposition to entrepreneurs	6	.8	4	2.4
Total Internal	**367**	**50.9**	**104**	**62.7**
Inadequate resources	113	15.7	32	19.2
Laws, regulations	48	6.7	7	4.2
Political opposition	21	2.9	6	3.6
Total Political	**182**	**25.2**	**45**	**27.1**
External doubts	70	9.7	9	5.4
Reaching target group	49	6.8	2	1.2
Affected interests	28	3.9	2	1.2
Public opposition	13	1.8	2	1.2
Private sector competition	12	1.7	2	1.2
Total External	**170**	**23.6**	**17**	**10.2**
Total	**721**	**100**	**166**	**100**

Note: Each occurrence is unique, so each subtotal is the sum of previous elements and the total percentage is 100. Total includes total internal, total political, and total external.

Figure 3. Obstacles to Innovation.[59]

After identifying the obstacles to innovation, Borins identified methods that successful government innovators used to overcome those obstacles. As shown in Figure 4, he found more than half of the methods used could be classified as either persuasion or accommodation. Borins noted that innovators rarely used strong arm tactics to gain consensus, but instead relied on getting others to see the benefits of the innovation, and adapting innovations in response to opponent concerns. Outside of persuasion and accommodation, finding additional resources and persistence were the two main methods used to overcome obstacles.

[59] Borins, "The Challenge of Innovating in Government," 19.

Table 3: Tactics to Overcome Obstacles to Innovation, Total Frequency Used

Tactic	U.S., number of cites	U.S., percent of total	Commonwealth, number of cites	Commonwealth, percent of total
Show benefits of program to opponents	73	9.6	34	16.8
Social marketing	52	6.8	4	2.0
Demonstration project	41	5.3	2	1.0
Total persuasion	**166**	**21.8**	**40**	**19.8**
Training affected parties	76	10.0	16	7.9
Consultation with affected parties	75	9.9	9	4.5
Co-optation (opponents become participants in program)	60	7.9	18	8.9
Program design made culturally or linguistically sensitive	16	2.1	1	.5
Compensation for losers	11	1.4	1	.5
Total accommodation	**238**	**31.3**	**45**	**22.3**
Finding additional resources	72	9.5	19	9.4
Persistence, effort	69	9.1	8	4.0
Logistical problems resolved	52	6.9	11	5.4
Other	36	4.7	44	21.8
Gaining political support, building alliances	36	4.7	3	1.5
Focus on most important aspects of innovation, have clear vision	27	3.6	5	2.5
Modify technology	26	3.4	20	10
Legislation or regulations changed	20	2.6	6	3.0
Provide recognition for program participants or supporters	9	1.2	0	0
Change managers responsible for program implementation	8	1.1	1	.5
Total	**759**	**100**	**202**	**100**

Note: Each occurrence is unique, so each subtotal is the sum of previous elements and the total percentage is 100.

Figure 4. Tactics to Overcome Obstacles to Innovation, Total Frequency Used.[60]

[60] Borins, "The Challenge of Innovating in Government," 22.

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IV. COAST GUARD'S INNOVATION PROGRAM

A. HISTORY AND STRUCTURE

The Coast Guard's current innovation program is managed by the headquarters Office of Performance Management and Decision Support (CG-0931). As one indication of the importance of the program, CG-0931 is the only office that reports directly to the Chief of Staff of the Coast Guard. It is led by a Coast Guard captain supported by a staff of twenty-two at headquarters and an additional twenty-four Organizational Performance Consultants (OPCs) geographically dispersed around the United States.[61] CG-0931's overarching mission is to support continuous improvement, business intelligence, innovation, and performance excellence.

Within CG-0931, two full-time positions manage the innovation program. Their efforts are complemented on a part-time basis by an Innovation Council and OPCs who support innovation as part of their overall process improvement responsibilities. Together they help distribute innovation grants, determine innovation award winners, align graduate team support for innovations, and facilitate innovators through the innovation process.

B. THE INNOVATION COUNCIL

The Innovation Council is composed of a group of twenty-seven well respected military and civilian volunteers from each of the nine Coast Guard headquarters directorates. They are complemented by three field councils--one each on the east and west coasts and a third responsible specifically for headquarters. The field councils help the Innovation Council disseminate information about innovation initiatives to the field and serve as initial reviewers when innovations are submitted. Council duties are a part-time collateral responsibility for all members. Military members typically only serve a four-year period while civilians serve indefinitely. This combination helps ensure new

[61] As an indication of visibility of the program, CG-0931 is the only office that reports directly to the Coast Guard Chief of Staff.

members are able to join the council to provide fresh perspective while the others who remain provide experience on long-term strategy because they see results of projects that may take years to develop fully.

The Innovation Council meets quarterly to review innovations, make decisions on how to allocate a limited amount of seed money to support worthy initiatives, determine innovation award winners, and to help transition field innovations to major CG programs for continued support. Often the Innovation Council in partnership with its field councils serve as connectors within the Coast Guard to ensure that initiatives are reviewed by official programs that may be working on similar initiatives. Money is ultimately provided to field innovations that either meet a requirement not yet served by an official program or to initiatives that are complementary to ongoing formal efforts in the same area.

C. ORGANIZATIONAL PERFORMANCE CONSULTANTS

Twenty-four Organizational Performance Consultants (OPCs), dispersed around the continental U.S., Alaska, and Hawaii, work for the headquarters Office of Performance Management and Decision Support (CG-0931). They are selected based on their expertise in the field of continuous improvement and a proven record of accomplishments across multiple fields. The composition of this group is divided equally between government service civilians who do not rotate from the positions and uniformed Coast Guard personnel who rotate from operational Coast Guard positions to serve four-year tours in the position. The majority of OPCs have advanced degrees in business or mathematics and all receive additional training to learn consulting and facilitation skills. Additionally, they are provided funding and time each year to pursue further professional development in the consulting field.

The OPC mission is to drive performance excellence throughout the Coast Guard through the use of continuous improvement principles, innovation, strategic planning, and project management. Organizational Performance Consultants are one of the few

groups within the Coast Guard freed from the tyranny of the present.[62] They are not required to stand duty and are specifically limited by policy to one day or less per month of collateral duties that detract from performing their process improvement mission. All OPCs are responsible for promoting ten core areas of performance excellence; the two most relevant to this paper are innovation and supporting National Graduate School teams.

One of the core missions of the OPC corps is to identify systemic issues and best practices at the Coast Guard units they visit. Often, Coast Guard personnel know how to achieve improved performance, but decide not to pursue improvements due to the pace of operations and the daunting amount of work required to address bureaucratic requirements associated with changing a sub-optimal process or introducing something new.[63] As internal consultants, OPCs are able to facilitate the innovation process by helping units develop a business case for their innovation and providing the extra energy required to navigate an innovation through necessary bureaucratic processes. Because of their diverse backgrounds and the number of units OPCs interact with, they also serve as connectors within the organization and can quickly build a collaborative network to support and move an innovation forward.[64] Many OPCs serve as members for the innovation field councils and are well positioned to serve as primary reviewers or advocates for innovations submitted.

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[62] Scott Karp captured Admiral Allen's remarks regarding tyranny of the present in a blog posting on the Excellence in Government website: "U.S. Coast Guard Commandant Admiral Thad W. Allen gave a stirring breakfast keynote on what he termed 'The Tyranny of the Present' -- all of the decisions that we make in the pressure of the moment that have serious, long-term consequences. Admiral Allen said that government needs to operate with "strategic intent," where short-term decisions are evaluated for the long term consequences. As he pointed out, the absence of a deliberate strategy is still a de facto strategy." http://blog.excelgov.com/2006/07/admiral_thad_allen_on_the_tyra_1.html (accessed January 21, 2008).

[63] These requirements range from fairly simple Local Control Configuration Board approvals that can be completed and approved with relatively little effort by someone who knows the process, to time-consuming and complex requirements like the Coast Guard's System Development Life Cycle process and the Federal Information Security Management Act which can require years and hundreds of hours to navigate and complete.

[64] Tipping Point.

D. NATIONAL GRADUATE SCHOOL TEAMS

The National Graduate School (NGS) provides public and private working professionals the opportunity to earn an accredited Master of Science degree in Quality Systems Management through a one-year applied learning curriculum. Students enrolled in the degree program are required to form process improvement teams and complete a project demonstrating measurable process improvements for an actual business process in government or industry. The short time frame to complete a worthwhile project coupled with the curriculum taught by the school and its requirement for senior champions to provide documented support has consistently led NGS teams to deliver substantial results for both industry and government.

In 2001, LCDR Lillian Maizer, an Organizational Performance Consultant in Boston, recognized that there was more process improvement work than the OPC cadre could adequately address. After conducting research on ways to expand the capacity of her office, she found the NGS program was the ideal vehicle to accomplish her objectives while also professionally developing leaders with quality and process improvement principles. LCDR Maizer negotiated with the school for three class sites in the Northeast and a reduced rate for Coast Guard personnel. She then visited field units and ultimately recruited 27 Coast Guard personnel to enter NGS' accredited Masters of Science in Quality Systems Management program.[65] While continuing to work full time, those personnel formed seven process improvement teams, and within a year, their projects delivered process improvements worth $9 million to the Coast Guard.[66] In recognition of the innovative approach to accomplishing her mission, in 2003 the Innovation Council awarded LCDR Maizer its first innovation award in the category of Administration, Training, and Support.

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[65] Andrew Shinn, "27 Coast Guardsmen Earn Masters Degrees," *Coast Guard Magazine*, June 2003, 13 http://www.uscg.mil/hq/g-cp/cb/PDFs/june2003.pdf (accessed December 27, 2007).

[66] Ibid.

Based on the NGS program's success in the Coast Guard's First District, the program was deployed throughout the Coast Guard. To assist its launch, the Innovation Council provided innovation scholarships to help offset the cost of the program for Coast Guard employees. Coupled with the Coast Guard's Tuition Assistance Program and a discount offered by NGS, students were able to earn a business masters degree for only $2,800.00 of their own money. Between 2003, when innovation scholarships were first offered, and 2005 when they were stopped, the Innovation Council provided $400,000 dollars in scholarships. In 2004, for the first time in its history, the Tuition Assistance Program received more requests for assistance than its budget could support. The Coast Guard's Chief of Staff personally intervened to ensure funds were found to support all tuition assistance requests.

Since the first class began in 2002, 450 students have received Masters of Science degrees while continuing to work full time supporting Coast Guard missions.[67] Those students formed 107 process improvement teams that have delivered process improvements valued to be worth $300 million by Coast Guard leadership.[68] Coast Guard NGS teams have received several national awards, and many NGS graduates have gone on to earn additional masters' degrees at more traditional and well-recognized schools like Harvard, the Naval Postgraduate School, and the Naval War College.

In addition to the $400,000 in innovation scholarships, the Innovation Council has provided over $700,000 to support initiatives stemming from NGS projects.[69] Formal headquarter programs have built upon that seed money by contributing more than $5 million in additional funds.[70]

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[67] The National Graduate School, http://www.ngs.edu/uscg/html/welcome.htm (accessed February 20, 2008).

[68] The National Graduate School, http://www.ngs.edu/cg_sponsored/index.html (accessed January 21, 2008).

[69] $75,000 for ASCC, $150,000 for aviation, $20,000 in awards, 25,000 for MISLE Lite, $250,000 for FalconView, $50,000 for Geospatial Product Library, $23,000 for AIS Racon replacements, $20,000 for AIS on HU-25's, $42,000 for AIS/EAIS for aircraft, $26,000 for small arms marksman training system.

[70] $1.25 million in follow on funds from CG aviation, $4 million from USCG Deepwater program, and funding for full time programming staff for MISLE Lite and MISLE Mobile.

E. THE INNOVATION PROCESS

The Coast Guard's formal innovation process is broken down into five steps:

1. Idea Submission
2. Initial Review
3. Primary Review
4. Classification / Action
5. Final Disposition

1. Step 1 - Idea Submission

Anyone within the Coast Guard can access the innovation database and review information about past and current innovation efforts. If someone desires to add a new idea to the database and request support, they are able to fill out a form that prompts them to define the problem they would like to address, estimate the time or money the innovation is capable of saving, and outline a request for funding or other support needed to support their innovation.

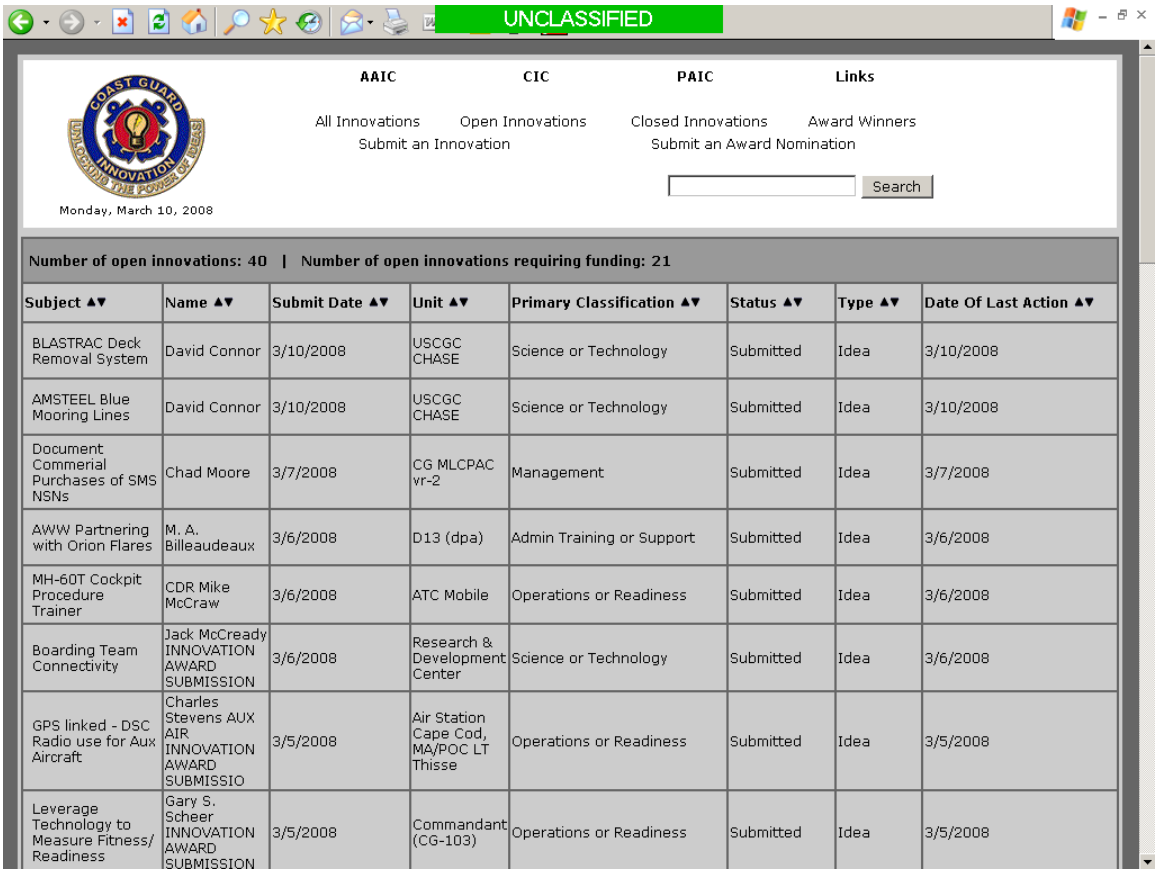

Figure 5. Coast Guard Innovation Database.

2. Step 2 - Initial Review

Once an innovation is submitted, representatives from each of the field councils and the headquarters Innovation Council receive an e-mail alert with a link to the submission. After an initial review, a primary reviewer is assigned based on the geographic location and type of innovation.

3. Step 3 - Primary Review

The primary reviewer is responsible for contacting the individual who submitted the innovation proposal to discuss the idea and gather any additional information needed to evaluate the idea. Once enough information is gathered, the primary reviewer is responsible for coordinating evaluation of the idea by any Coast Guard programs or

experts that may be responsible for any areas an innovation may touch. The goal is to conduct the review as expeditiously as possible to ascertain whether the innovation complements ongoing efforts and whether partners are available to work with the innovator to ensure the innovation is aligned with and supports overall Coast Guard efforts. Once the primary review is completed, the reviewer is responsible for submitting his or her findings to the appropriate field council or headquarters Innovation Council for final disposition.

4. Step 4 - Classification / Action

Based on the information provided from the primary review, the Innovation Council is responsible for determining what impact the innovation might have on the Coast Guard. The council supports innovations that support ongoing program initiatives as well as innovations that may be seen as disruptive by certain Coast Guard programs. Once a decision is made to support an innovation, the innovator is empowered to proceed with little further oversight from the Innovation Council.

5. Step 5 - Final Disposition

Innovation Council members review open innovations at their quarterly meetings for status updates and to determine if further assistance is needed. Innovations are closed when they are transitioned to a formal program or process, or when the innovation has run its course and is no longer viable because the innovator has transferred or the innovation has been overcome by other events.

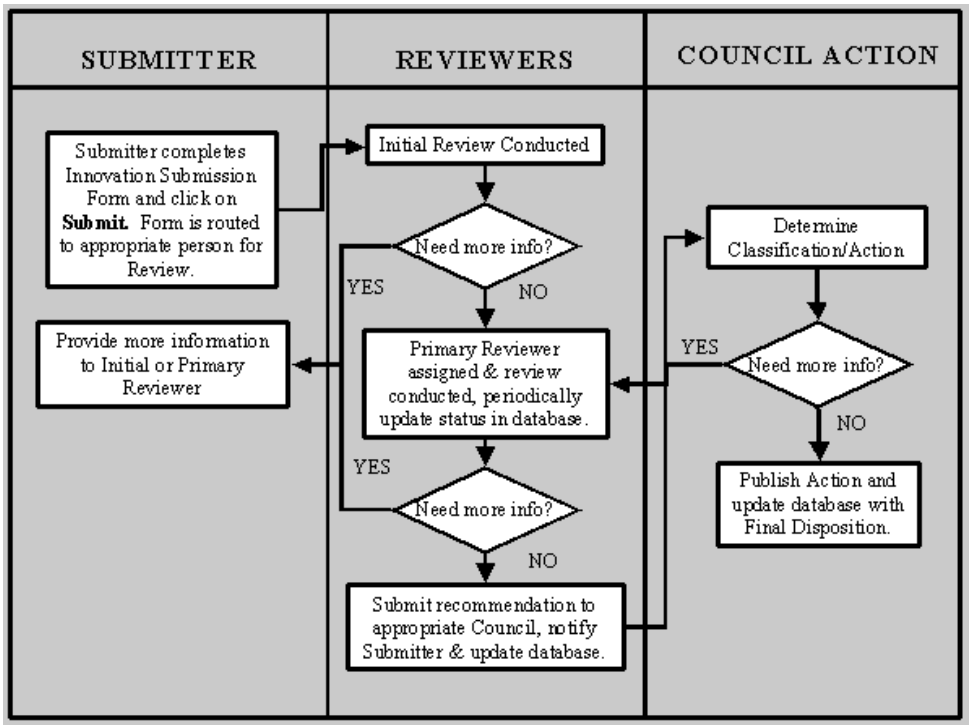

Figure 6. Coast Guard Innovation Process Flow Chart.

F. INNOVATION VENTURE CAPITAL FUND

Funding to support the program fluctuates from year to year, but historically the Council is allocated between $1.5 to $4 million annually to support the CG's Innovation Expo and provide seed money for projects. From fiscal year 2003 until fiscal year 2008, the Innovation Council spent $9.5 million in support of innovation.[71] Significant expenditures include $2 million to support annual innovation expos and awards, $1.3 million in support of improved information systems for boarding officers and aircrews, $2.8 million in support of e-Coast Guard initiatives, and over $1 million to support non technology related programs such as $400,000 to support innovation scholarships for Coast Guard personnel attending the National Graduate School masters program.[72]

[71] Fred Hooghouse, USCG Innovation Manager interview with author including Excel spreadsheet documenting expenditures, August 2, 2007. Documentation on innovation expenditures prior to fiscal year 2003 was not provided.

[72] Hooghouse, USCG Innovation Manager interview.

The funds are used to support the initial launch of worthy innovation projects and have also served as a bridge until the budgetary process, often a three-year process, can catch up with formal program funding and support.[73] The Innovation Council attempts to fund as many projects as possible by focusing on projects with modest funding requirements or through cost-sharing agreements with established programs within the Coast Guard or DHS.

G. THE INNOVATION EXPO

The Innovation Council began hosting Innovation Expos in the spring of 2001. The first was managed internally and held at the Coast Guard Academy. Thirty-eight booths presented their work to two hundred attendees.[74] Building upon their success, the Innovation Council held its second expo at a large hotel in Baltimore, Maryland, and allowed the National Defense Industrial Association (NDIA) to manage the event. Only Coast Guard teams were allowed to present their work, but industry representatives were invited to attend and view teams' projects. The number of exhibits nearly doubled from the previous year to sixty-five, and because the expo was held in conjunction with the Coast Guard's Flag conference, all senior leadership attended the expo and met with each innovator.

In 2003, The Innovation Council followed up on its success of the previous year by holding the event at the same Baltimore location in conjunction with the Flag conference. For the first time, they allowed industry to purchase booths and display alongside Coast Guard teams. One hundred eight booths presented innovations to 900 attendees including, once again, the Coast Guard's senior leadership.[75] The considerably larger turnout that year exceeded the capacity of the hotel's conference space, and as a result all subsequent Innovation Expos have been held in dedicated convention centers. Since 2003, expos have been held annually in Savannah, Georgia; Santa Clara,

[73] Resource proposals submitted and approved in fiscal year 2007 will not receive funds until 2010.

[74] Fred Hooghouse, e-mail dated December 27, 2007.

[75] Ibid.

California; Tampa, Florida; and New Orleans, Louisiana. The numbers of exhibits and attendees per year have stabilized around three hundred and 2,000 respectively.[76]

The Coast Guard's Innovation Expo is much more than personnel presenting their innovations – it is the Coast Guard's one major annual gathering. Conference space is made available at no cost for any Coast Guard community to hold a conference. Coast Guard senior leaders, as well as other communities such as Electronics Support, Naval Support, and Civil Engineering communities have held national conferences in conjunction with the Innovation Expo. Loosely formed innovation teams collaborating around the nation are also able to reserve rooms at no cost to meet privately and work on their initiatives away from the distraction of the exhibit hall.

In addition to the innovation booths and the conferences held at the Innovation Expo, keynote addresses are provided by senior Department of Homeland Security, Coast Guard, and other leaders in government to share the vision and the challenges their organizations face. To help foster an innovative Coast Guard culture, nationally recognized experts on innovation and change management are also invited to provide informative sessions on how to lead change and successfully innovate.

The Innovation Expo's combination of educational sessions, keynote addresses, innovation booths, and social networking opportunities serves as a fertile environment for innovation. Innovators are able to see what others are doing and establish connections with teams working on similar or complementary initiatives. The addition of industry booths allows field innovators to see what industry is capable of providing, and allows industry to gain insight from some of the Coast Guard's most forward-leaning personnel by being able to see what they are working on and speaking directly about the issues Coast Guardsmen are trying to resolve. The Innovation Expo also serves as a highly visible sign to the rest of the Coast Guard that senior leadership is committed to supporting innovation throughout the Coast Guard.

[76] Hooghouse, e-mail dated December 27, 2007.

H. INNOVATION AWARDS

The Coast Guard's Innovation Award Program is named in honor of Captain Niels P. Thomsen, a World War II hero and inventor of a chain-stopper system used by Coast Guard buoy tenders to secure and safely release the chain and sinkers for buoys. The innovation significantly improved the safety of buoy operations, and more than fifty years later it is still an integral part of Coast Guard buoy operations.[77]

The Captain Niels Thomsen Award was first established in 2003 to recognize innovators for their achievements in one of four categories: Science or Technology; Operations or Readiness; Administration, Training, or Support; or Management. Five months after winning the first Innovation Management Award, CDR Joel Magnussen passed away from the cancer he had been battling for more than a year. In recognition of his outstanding character, passion, vision, and inspiration to others, that award is now called the CDR Joel Magnussen Innovation Award for Management. His widow, Jennifer, attends the annual Innovation Expo each year to present Joel's award to other Coast Guardsmen following in his footsteps. Over the five years since it was introduced, dozens of award winners have been recognized for their accomplishments. Award winners have gone on to be nationally recognized for their work, and several of their innovation projects have been implemented nationally throughout the Coast Guard.

[77] United States Coast Guard, http://www.uscg.mil/innovation/passingofcaptnielspthomsen.asp (accessed January 21, 2008).

V. FOCUS ON FOUR SUCCESSFUL INNOVATION PROJECTS

This section will focus on four separate but related innovations to show how Coast Guardsmen used the innovation program to drive significant organizational improvements. In the descriptions of these projects readers should recognize the principles of change management, innovation, and collaboration discussed earlier in the literature review. Critical success factors identified by the Borins report on government innovation will be used to analyze each innovation project. Neal Thornberry's two-by-two framework will also be used to analyze specific roles exhibited during the development of the innovations. As you read through each case study, readers should look for the integrators, accelerators, miners, and explorers that will be discussed in detail after the case study.

The Innovation Council views every supported innovation as an opportunity to help the Coast Guard learn and explore various avenues of systemic improvement. Innovations that fail to fully develop and deliver returns on investment are treated as valued probes into the future. From the Innovation Council's perspective, the insight each innovation provides the Coast Guard makes it a success.

This study will focus on four interrelated innovations that emerged between September 2001 and January 2008 to illustrate how the Coast Guard's many supported initiatives created synergies and collaboration that allowed each innovation to build upon and complement other innovations. While the focus appears narrow, the four projects address nearly half the Innovation Council-funded initiatives during that time frame. The impact of funding for Innovation Expos and awards, NGS scholarships, OPC support, as well as several other reinforcing factors can be seen as each of the innovations is discussed. A follow-on case study planned by other researchers may provide a more comprehensive understanding of every Coast Guard innovation project, but it is beyond the scope of this thesis.

The first innovation, an application to improve Coast Guard vessel sighting reports from aircraft, grew out of an earlier innovation that helped Coast Guard law enforcement officers conduct vessel boardings through the use of a Personal Digital Assistant (PDA). Innovation work on the vessel sighting application helped launch two additional innovations, an improved mission planning and execution system and the use of tablet computers. From those three innovations, an Iridium data linking solution that provides global tracking and two-way communication with Coast Guard Aircraft emerged. Each innovation and the synergies created between them by the Coast Guard's innovation program will be discussed in greater detail below.

A. VESSEL SIGHTING APPLICATION - MISLE LITE

Before discussing the vessel sighting innovation, it is important to understand what took place before the innovation that allowed it to emerge. In 2001, CDR Dan Hardin, a Coast Guard field innovator from Seattle, replaced Coast Guard boarding forms with electronic versions on a Personal Digital Assistant.[78] This innovation was demonstrated at the Coast Guard's first Innovation Expo in 2001. Seeing the benefits of the new approach and recognizing the emergence of portable information devices, Coast Guard leaders chose to develop the local innovation into an enterprise solution that could upload information directly into the Coast Guard's the Maritime Information for Safety and Law Enforcement (MISLE) system, a web-based database built to capture all Coast Guard law enforcement and rescue activities. The innovation came to be known as the Boarding Officer Job Performance Aid (BO JPA).

An improved version of the Boarding Officer tool was presented in May of 2002 at the Coast Guard's second Innovation Expo. Several positive developments resulted from that second Expo. First, the Innovation Council provided an innovation grant for $700,000 to continue work on the tool. This funding was used in part to support the work of a team of programmers at the Coast Guard's Operations Systems Center (OSC) to

[78] Bob DeYoung, former USCG computer programmer, interview February 24, 2008.

work on the project full time.[79] The second significant outcome from the 2002 Innovation Expo was the synergy created with another PDA innovation booth focused on using PDAs in aviation. The Boarding Officer Job Performance Aid (BO JPA) team had been looking for a ruggedized solution for their PDAs to survive the harsh ocean environment, but each solution they found doubled or tripled the cost of a standard PDA and was therefore cost prohibitive. In the aviation booth next to them, they found a $50 solution that made a regular PDA completely ruggedized and capable of withstanding the harsh Boarding Officer environment.[80] The information exchange also helped the PDA aviation booth recognize that the solution being built for boarding officers could easily be expanded to include vessel sightings from aircraft. The relationships formed and the information shared between the booths laid the foundation for a collaborative relationship that still exists nearly six years later.[81]

As one of the presenters in the aviation booth, I returned from the 2002 Innovation Expo full of ideas and energy about how we could improve operations at our air station. I was part of a group of ten aviators at Air Station Cape Cod who had enrolled in the National Graduate School masters program that Lieutenant Commander Maizer had identified for us. Despite the high operations tempo in the months following the 9/11 attacks of the previous year, our Operations Officer, Commander Jack Santucci, had encouraged those working for him to enroll in the NGS program. He ultimately allowed one quarter of his pilots to attend classes on nights and weekends despite the limiting effect it would have on his ability to schedule operations during those times.

In order to graduate, the NGS program requires students to form process improvement teams and deliver tangible improvements prior to their graduation date. By May 2002, Air Station Cape Cod students had formed three process improvement teams. One, led by Lieutenant Commander Mark Morin, focused on improving the process used

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[79] Before disbanding, this team would serve an integral role in the development of several other innovations and its leader would eventually be recognized with an innovation award for his efforts.

[80] Solution was to use an Otterbox (www.otterbox.com) (accessed January 20, 2008).

[81] Some of the same key figures from the two innovation booths in 2002 are currently collaborating on an improved user interface for aviators to send information to the MISLE database in near real time under the Airborne Data Communications System (ADCS).

to report vessel positions during our daily surveillance flights. His team named themselves the Maritime Awareness Data Dissemination (MADD) graduate team and began analyzing the processes used by Coast Guard aircraft to report vessel positions. I shared the information I had learned at the Innovation Expo about the Boarding Officer Job Performance Aid and told them that the programmers appeared willing to add a vessel sighting page to the application. Based on their analysis and the information from the Innovation Expo, they hypothesized that using a PDA would significantly improve efficiency and effectiveness over the paper-based process then in use.

Using the data they had collected regarding the inefficiencies inherent in the paper-based process in addition to the inside knowledge that it would be fairly simple to add a vessel sighting page to the PDA application already in development, LCDR Morin successfully convinced headquarters to support adding an aviation screen to the Boarding Officer application. At approximately the same time, the Innovation Council provided a $10,000 innovation grant to Air Station Cape Cod to purchase hardware and software to implement ideas they presented at the Expo. The grant was used to purchase hardware and software that met multiple requirements including those identified by the MADD team. Within three months of the Innovation Expo that had originally sparked the idea of a PDA vessel sighting entry form, the PDA programmers at the Operations Systems Center had added the aircraft vessel sighting page to their application and were ready for the MADD team to test it. In an effort to keep costs down, lead programmer Bob DeYoung used his personal vehicle to drive his team of programmers the five hundred miles between their offices in Martinsburg, WV and the air station in Cape Cod, Massachusetts.

The initial meeting between the MADD team and OSC programmers got off to a rough start.[82] The vessel sighting application required the user to enter data on three separate pages, but the MADD team demanded all the information be captured on a single page. Bob DeYoung pointed out that there was not enough room on a PDA screen to capture all the data, but the aviators would not budge from their requirement for a

[82] The author facilitated this meeting.

single page. To help settle the matter, the entire group of aviators and programmers went flying to test the three-page application. Seeing firsthand what the aviators were required to do in order to "sight" a vessel was very enlightening for the programmers. They were noticeably excited and engaged by the experience. By the time they landed, the programmers all agreed that a single page data entry form was required and promised to figure out a way to achieve it.

Due to vibration and other environmental factors, the screen size of PDAs proved to be a major drawback not only for the vessel sighting application, but also for all other applications the air station intended to use in flight. The team recognized the need for a bigger display area, and used their innovation grant to purchase larger Microsoft Windows CE devices commonly referred to as "web pads." The larger displays worked well in flight; however, the platform required programming changes for OSC's PDA application to work on it. Despite significant lobbying from Air Station Cape Cod and the MADD team, the program manager responsible for the application at headquarters refused to allow the changes necessary to make the application work on a hardware platform that no other unit in the Coast Guard used or planned to use.[83] He did, however, agree to allow Bob DeYoung's team to do the work necessary to allow the application to run on laptop or desktop computers.

Without knowing it, the program manager's decision to allow the PDA application to run on computers perfectly fit with the direction the air station's operational tests had been leading. The testing determined that PDAs were unsuitable due to their screen size, and that "web pads" were unsuitable because of they lacked compatibility with OSC's PDA application. Both devices also lacked the processing and storage capabilities needed to utilize the moving mapping applications fully that had been tested. At the Innovation Expo earlier that year, new "Tablet PCs" were displayed and appeared to address all the deficiencies noted with PDA's and web-pads.

[83] The program manager was unhappy with the scope creep created by the addition of aviation requirements to an application meant primarily for boarding officers.

Using contacts established at the Innovation Expo, Air Station Cape Cod arranged for Microsoft to provide a Tablet demonstration at their base.[84] The new Tablet PC performed exceptionally well and met all operational requirements. The air station used the last of its innovation grant to purchase one non-rugged tablet PC along with extra batteries for testing. As expected, all the applications on PDA devices worked exponentially better using the tablet PC and its more powerful computing processes.

With headquarters' approval to develop the PDA vessel sighting application for laptop computers, Bob DeYoung entered a spiral development process with the air station that would often generate two or three new software versions in a single day. Each new version would be tested in flight, and feedback would be immediately provided to Bob on how to tweak the application for better performance. Building on the lessons learned from each day of operational testing, more than a hundred new versions were generated over a three-month period.

The result of the rapid spiral development was a one page data entry form that met all MADD team requirements. In addition to meeting the graduate team's requirements, the spiral development led to the application being linked with a commercial off-the-shelf moving map program to get automatic position and time information. It also provided automatic alerts and links to important information regarding any vessels sighted. Bob designed the application to work on the Coast Guard's Standard Computing workstations without the need for an administrator to load the software. Doing so avoided bureaucratic hurdles and high costs associated with applications that required computer administrator rights, and it also made it easy for anyone in the Coast Guard to download and test the application on their work station.[85]

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[84] The Microsoft representative thought he was visiting a unit full of engineers and appeared disappointed to find out he was only presenting to operational end users. He likely thought his time had been wasted, but it planted the seed that led the Coast Guard to purchase the first Toughbook Tablet PCs, which ultimately led to its approval as a standard Coast Guard computing platform.

[85] Requiring an administrator to load the application would have required the application to enter a tedious and expensive bureaucratic process of testing and documentation to address life cycle support costs. Ultimately, this was completed, but only after the value of the application had been widely demonstrated throughout the Coast Guard on both surface and air units.

Based on the work we had done on the vessel sighting and mapping applications, I was selected to fly an HH60 Jayhawk helicopter to Washington D.C. in March of 2003 to photograph and map helicopter landing sites in the region. Part of the mission included transporting the Coast Guard Commandant, Admiral Collins, along with his executive assistant, Captain Pekoske, around the region for a day. Prior to the flight, our crew was specifically ordered not to brief the commandant on Air Station Cape Cod's innovation project. We agreed, but since we were using the tablet PC to conduct our mission, the commandant immediately began asking questions about it once airborne. He ultimately ended up using the tablet to see where we were flying and to access information about landing sites and critical infrastructure. Holding the sleek tablet PC and watching the moving map with its embedded information at his fingertips, the commandant remarked that it was exactly in line with his vision of "e-Coast Guard." Shortly after the flight, he mentioned the innovation effort in his annual State of the Coast Guard, which provided a boost to the fledgling grass roots effort.

The MADD team's final report demonstrated that the vessel sighting application provided $1.68 million in process improvements and cost avoidance annually for Air Station Cape Cod. The report recommended that a real-time data link be added to the solution in order to capture even greater benefit.[86] Later that spring, the Innovation Council recognized Air Station Cape Cod's effort with an Innovation Award at the 2003 Innovation Expo. Rear Admiral Crea, the senior champion for the effort, attended the team's graduation and was also present at the Innovation Expo to personally congratulate them for their effort.

The innovation seemed to be a wild success and ready to be deployed nationally, but by the fall of 2003, it was slowly beginning to disintegrate. Bob DeYoung and his team of programmers were accused of "serving as a back door to give the field what they

[86] The National Graduate School Project Database, http://www.ngs.edu/cg_sponsored/AviationSurveillance(MISLE)($1,700,000).html (accessed January 2, 2008).

wanted from MISLE" and they were ultimately reassigned to other projects.[87] At Air Station Cape Cod, the MADD graduate team had disbanded upon graduation. CDR Santucci, who had played a critical role in protecting and fostering the innovation work by providing time, funds, and protection from outside efforts to kill it, had transferred.

Once again, the Innovation Council stepped in to provide assistance. The captain in charge of the innovation program, Geoff Abbott, arranged for me to transfer into LCDR Maizer's Boston OPC position in the summer of 2004 to ensure continued support for the innovation effort. The Council also provided an additional $150,000 to Coast Guard aviation to replicate the solution throughout Coast Guard aviation. Their efforts paid off; Air Station Cape Cod continued to pilot the vessel sighting application, and while being but one of twenty-six air stations, they recorded more than half of the Coast Guard aviation sightings between 2004 and 2007.[88] By the spring of 2006, the vessel sighting application had expanded to include surface operation needs and was deployed nationally as MISLE Lite with formal funding support. A dedicated team of programmers used the lessons learned to build an improved PDA version, and are now working on an improved version for tablet PCs called MISLE Mobile.

B. RUGGEDIZED TABLET COMPUTER

The one non-ruggedized tablet PC Air Station Cape Cod used to demonstrate the MISLE Lite vessel sighting application worked well, but it was clear it would not survive the harsh salt water environment in which Coast Guard aircraft regularly operate. Early in 2003, the air station returned to the Innovation Council with a request for more funds to purchase ruggedized computers and received an additional $65,000. Using contact information from the 2002 Innovation Expo, the air station arranged for a Panasonic computer representative to visit and demonstrate the Toughbook computers. The representative brought Panasonic's main ruggedized computer at the time, a CF-28 laptop computer, along with a new model that would soon be manufactured, the CF-18 tablet

[87] Bob DeYoung, interview.

[88] Coast Guard Business Intelligence, total aviation vessel sightings throughout the Coast Guard between October 1, 2004 and January 1, 2008 was 17,510. Air Station Cape Cod accounted for 9,019 of the total, or 51.5%.

computer. The CF-18's smaller size and form factor perfectly met the air station's requirements; however, there were two problems. First, because it had not yet been manufactured it would not be available prior to the 2003 Innovation Expo. Second, Coast Guard regulations required units to purchase standard approved computers or follow a waiver process to gain one-time approval for a purchase. The air station knew that process would be lengthy and laborious because the equipment did not yet exist, and our operational requirements for the vessel sighting and moving mapping applications were unfamiliar to approving officials.

With the 2003 Innovation Expo quickly approaching, Air Station Cape Cod decided to purchase two CF-28 laptops paired with Panasonic's Mobile Display Wireless Device (MDWD) immediately, a small slate-like device that allowed the operator to see and control the main computer's display wirelessly. The small, lightweight form factor was slightly smaller than the "web pads" the air station had been using and would help fill the gap until the CF-18 tablet computers arrived. The air station placed four CF-18s on back order and requested that Panasonic send the first ones that entered production. In addition to the computers, the air station also purchased many spare batteries--the reason for which will be discussed later. Even though the air station had identified the right equipment to meet its needs and had the funds available to make the procurement, one significant hurdle remained. The air station needed to convince a procurement officer to go outside formal policy to make the purchase.

Aviators took the non-ruggedized tablet PC they had been using to Air Station Cape Cod's procurement office and showed them how it enabled missions to be conducted more safely and effectively.[89] Aviators explained how the tablet had been dropped and splashed with water several times and showed procurement officials how the Toughbook computers were designed to stand up to that type of abuse. Aviators also explained that they did not have the required waiver to purchase the ruggedized computers, but asked that an exception be made since the funds had been provided by the Innovation Council to purchase innovative equipment.

[89] Air Station Cape Cod was able to purchase the non-rugged tablet PC previously because it fell under a $2,500 cap and therefore did not require procurement officer approval.

Seeing the benefits of the solution, junior enlisted members of the procurement office made a leadership decision to go outside standard policy and completed the required paperwork in less than a week, far ahead of the sixty-day period they were allowed under procurement regulations. Had they wanted to, those junior enlisted members could have used Coast Guard policy to justify blocking the procurement, but they recognized the benefits of the solution and assumed some risk by completing the procurement documentation and presenting it to the contracting officer for signature. As a result, Air Station Cape Cod received the CF-28 laptops and MDWDs prior to the 2003 Innovation Expo and was one of the first in government to use CF-18 tablet computers.[90]

After receiving the Toughbook computers, Air Station Cape Cod faced numerous bureaucratic barriers to get the computers authorized for operational use. Approvals to connect the computers to the Coast Guard Data Network and to carry them onboard Coast Guard aircraft were required. After studying the policies carefully, aviators used the same risk based decision making skills they had been taught in Naval Flight School--as Coast Guard aircraft commanders they would navigate a difficult course of adhering to policy as much as possible while consciously circumventing it when needed to drive needed changes in policy.

At CDR Santucci's direction, the air station used Coast Guard aviation's Portable Electronic Device (PED) policy to get approval to carry the computers onboard Coast Guard aircraft. The PED policy was not as restrictive as other approval processes, and was in place to allow aircrews to carry cameras and computers along with other types of portable electronic equipment. The air station conducted all required testing procedures and documented the results required by the policy. The purchase of extra batteries with both the non-rugged and the rugged tablet computers previously mentioned were needed to allow us to adhere to the PED policy. According to that policy, equipment could not connect to the aircraft in any way, including power. Using swappable batteries, we ensured that the tablets performed throughout each mission without the need for external

[90] Michael Krouse, Interview with Panasonic representative who sold the tablet computers to Air Station Cape Cod, February 1, 2008.

power. We knew using aircraft power made more sense, but at the time, it would have slowed or stopped the initiative because the air station would have been required to follow a more laborious approval process.

Approval to connect to the Coast Guard Data Network proved more difficult to obtain than approval to carry the equipment on Coast Guard aircraft. Headquarters agreed to certify the new Toughbook tablets for the network, but said it would take two years to accomplish. Unsatisfied with that response, the air station found field experts to helped them see the benefits of the new system with the same strategies we used with the procurement specialists. Within two weeks, they provided a suitable solution that bridged the two-year bureaucratic approval barrier. As a result, Air Station Cape Cod was able to connect the computers to the Coast Guard Data Network years ahead of any other Coast Guard unit while official policy worked to catch up with the solution.

As previously mentioned with the MISLE Lite vessel sighting solution, by the fall of 2003 our entire innovation effort looked like it was doomed to failure. On October 23, 2003, I was assigned to fly the Vice Commandant of the Coast Guard, Vice Admiral Barrett, around the Northeast for the day in an HH60 Jayhawk helicopter. He had personally awarded me a Coast Guard Innovation Award for our efforts in May of that year, and during our flight he was able to see first-hand how we were using the CF-18, MISLE Lite, and our new FalconView moving mapping application to conduct our missions. The Vice Commandant asked questions about the solution throughout the flight and came to realize that the effort was at risk of failing.

On his first day back at headquarters, the Vice Commandant asked headquarters personnel to brief him that afternoon on what was being done to transition Air Station Cape Cod's innovations to the rest of Coast Guard aviation. The increased headquarters' attention that resulted from the Vice Commandant's visit not only helped secure the $150,000 innovation grant from Innovation Council but also $410,000 in matching funds from other programs to help launch the effort.[91]

[91] Mitch Morrison, CG-MPS Program Manager, e-mail message to author, January 19, 2008.

Space and Naval Warfare Systems Command (SPAWAR) was awarded a contract to procure hardware, provide help-desk support, and train Coast Guard aviators how to use the software. By June of 2005, SPAWAR Philadelphia had procured sixty-two CF-18 tablet computers and ensured they were loaded with all the necessary software for the air stations to use. When Hurricane Katrina impacted the Gulf coast, many of those computers were quickly loaded with maps and imagery of the area and shipped to the Coast Guard's air station in Mobile, Alabama.

Hurricane Katrina's initial landfall severely damaged and disabled the Coast Guard Command Center responsible for coordinating Coast Guard air rescue operations in the region. Coast Guardsmen established a temporary aviation command center in an avionics workshop that survived the storm, but because the hurricane had disabled the Coast Guard's Data Network they were initially forced to rely on paper maps, radios, and telephones to help coordinate and direct missions. After the CF-18 tablet computers arrived, one was equipped with an air card and served as the command center's only internet connection during the early recovery period.[92] Watch standers were able to use the CF-18 to convert addresses into geographic coordinates quickly and used the available imagery to improve situational awareness of their operations significantly. After hearing about the successful employment of air cards to assist efforts during the initial response effort, DHS requested the air card-equipped CF-18s be sent to New Orleans to assist recovery efforts there. Ultimately, 30 of the innovation-funded CF-18 tablets were loaded with imagery of the area, equipped with air cards, and deployed to support surface and air operations throughout the region.

Based in part on the operational successes of both the Toughbooks and the air cards during the response to Hurricane Katrina, Coast Guard headquarters formally granted enterprise approval for units to use CF-18 Toughbook tablet computers as well as wireless data connections in the spring of 2007. It is important to reflect that four years earlier junior enlisted members used their trained initiative and took a risk to go outside

[92] Jeffrey Rensink, USCG First Class Petty Officer Operations Center watch stander during Katrina rescue operations, interview with author, March 10, 2008.

policy that helped set in motion a chain of events leading to CF-18 computers being available for hurricane response efforts, and ultimately official Coast Guard approval.

C. COAST GUARD MISSION PLANNING AND EXECUTION SYSTEM (CG-MPS)

In conjunction with the MISLE Lite and Toughbook innovations, the air station had also incorporated a moving mapping solution to assist Coast Guard aircrews. The first application selected was a commercial off-the-shelf version made by Teletype GPS in Boston, Massachusetts. This solution provided aeronautical, street, and nautical maps on PDAs, web pads, and computers. Just as importantly, the company was located within an hour's drive of Air Station Cape Cod, close enough to visit if support was needed. Initially the application did not work as well as hoped, but after several trips to the company's headquarters, the air station was able to improve the software's overall capabilities and also integrate it with MISLE Lite. By the Innovation Expo in May 2003, MISLE Lite and the moving mapping application were completely integrated. Users could automatically retrieve position information from the mapping application for their sighting reports, and they could also graphically see their GPS trail and all vessels they had sighted during the patrol. Further refinements allowed operators to plot an unclassified version of the Coast Guard's common operating picture directly into their map prior to patrols. This allowed air crews to fly their patrol with better knowledge of the vessels along their route of flight and allowed them to simply update vessel positions or add vessels that had not yet been identified.

In December 2002, Air Station San Francisco had sent information to all other air stations about a moving map application called FalconView that was part of the Department of Defense (DoD) Portable Flight Planning System (PFPS). It was available to all Coast Guard units for free and already had a large DoD training and support network in place. From a military aviation perspective, it was far superior to the Teletype GPS solution Air Station Cape Cod had adopted, but it did not have street maps, address lookup capabilities, and it was not integrated with MISLE Lite.

Air Station Cape Cod sent a representative to a PFPS training session at an Army National Guard unit located nearby and ultimately made the difficult decision to replace the Teletype mapping software we had worked so hard to integrate into MISLE Lite with FalconView. The transition meant redoing much of the innovative work that had already been accomplished without any formal budget, and it also meant learning how to use a more complicated mapping system. Despite this, we knew the solution identified by Air Station San Francisco was the right solution for the Coast Guard in the long term.

Air Station Cape Cod formed a transcontinental collaboration with Air Station San Francisco, and innovators from both units began sharing information about how they were using the system to improve Coast Guard operations. Bob DeYoung was able to obtain a software development kit for FalconView from Georgia Technical Research Institute, and used it to replicate the capabilities he had built between MISLE Lite and the Teletype GPS software. By the Innovation Expo held in May of 2004, FalconView was integrated completely with MISLE Lite, and Coast Guard aviation had decided to use the Portable Flight Planning System (PFPS) to replace its aging legacy flight planning system.

Of the $560,000 made available through the $150,000 innovation grant and $410,000 in matching funds at headquarters, approximately half of the money was devoted to PFPS training and support needs within Coast Guard aviation. In June 2005, Bill Imle, the Air Station San Francisco Operations Officer who sent the original letter about PFPS in 2002, retired and accepted a contractor position working for SPAWAR to help implement PFPS and CF-18s throughout Coast Guard aviation.

By the time Hurricane Katrina made landfall on August 29, 2005, Bill had become an expert PFPS trainer, and recognized that the program could significantly enhance situational awareness for Coast Guard operations. Unfortunately, he had not been able to train a significant number of Coast Guardsmen prior to the storm's landfall, and there were only a few people inside the Coast Guard who knew how to use the system. Bill sent an urgent request for personnel and equipment to support deployment of PFPS for the relief operations. He was able to get approval from Headquarters to release the CF-18s stored in Philadelphia for immediate distribution, and I was sent to

support him. We spent nearly the whole month of September working together in support operations beginning in Mobile, Alabama, then transitioning to New Orleans, Louisiana, and finally to Austin, Texas in response to Hurricane Rita.

Based on our experience using PFPS that month, we were asked to brief many senior homeland security leaders including Rear Admiral Kunkel, Chief of Coast Guard Current Operations; Peter Verga, Principal Deputy Assistant Secretary of Defense for Homeland Defense; and Michael Wynne, Secretary of the Air Force. We were also invited to attend PFPS Technical Interchange Meetings with DoD program managers. Our work during Hurricanes Katrina and Rita and the follow up briefings with senior leaders helped the Coast Guard understand that PFPS was not just an aviation application, but a mission planning and execution system for surface units as well. To help ensure everyone understood it was a system that provided more than just aviation needs, the name was changed to the Coast Guard Mission Planning and Execution System (CG-MPS)

After he began attending quarterly meetings with his DoD counterparts, Bill Imle found the group that managed PFPS for the DoD was very innovative and had formed a powerful collaborative network to manage the application successfully. He was welcomed into the group as the Coast Guard's representative without any formal documentation or funding required. The collaboration immediately paid dividends for both the Coast Guard and DoD services. The DoD program managers used their resources to help the Coast Guard meet federal certification requirements needed for Coast Guard-wide deployment. They also shared many of their innovative approaches to address the needs of remote operators using their software. Due to the traditional budgetary process, the Coast Guard was unable to contribute funding to help share the expense of developing and maintaining the PFPS application, but was able to use innovation funds to improve the application for homeland security-specific applications. The Coast Guard strategically chose to fund capabilities that would also benefit our DoD counterparts and received contracting and program management support from them in return.

Based upon lessons learned from Hurricane Katrina and our experience with Teletype GPS, we used a $250,000 innovation grant from the Innovation Council to add address lookup capabilities, an Automatic Identification System (AIS) ship tracking component, and Cursor On Target functions to improve interoperability and situational awareness to the FalconView application. Though it was a very small contribution to the overall DoD software upgrades to PFPS, the Coast Guard was included as a partner in the entire upgrade process.

Tragically, Bill Imle was killed by a drunk driver on Labor Day of 2007. In the months prior to his death, he was fully energized, traveling as far as Alaska to conduct training at Coast Guard aviation units, meeting with partners to expand and grow the program to other parts of the Coast Guard, and working to further refine and integrate the solution for Coast Guard operations. By the summer of 2007, after five years of championing his vision, Bill knew the future of CG-MPS was secure. Because of his constant energy and attention, funding support was no longer a constant concern because the Coast Guard had embraced the solution. Two days before he was killed, Bill wrote me from gate 36C in Atlanta on his way home from an 80-hour week of training and meetings. Rather than complaining about the amount of work and the fact that it had caused him to miss half of his holiday weekend with his family, he was passionate. The brief excerpt from that e-mail will show you some of the passion and leadership Bill exhibited the entire time he led the implementation of CG-MPS.

From: Imle, William
Sent: Saturday, September 01, 2007 1:16 PM
To: Kluckhuhn, Christopher LCDR
Subject: RE: SEARCH ACTION PLAN GENERATOR

Chris:

From gate 36C at ATL...

I'm catching up on email. We had a marathon training day on Thursday: 0730 until 2200! The AIRSTA granted Friday libo so we taught most of the Friday students on Thursday night. Unfortunately, there were a few from another unit, and we didn't have good contact information for them and ended up back in the classroom at 0730 Friday to finish them up. All in all, it was good training.

Let me know if we have $ for the generator. We MUST have that tool.
Bill

Since Bill embodied nearly all of the Coast Guard's knowledge of CG-MPS and was its primary driver, there was concern that without him the effort would fail. After hearing about his untimely death, his Coast Guard comrades, junior and senior, pulled together to ensure his vision was not lost. Funding has been added to use FalconView as the user interface for the Airborne Data Communications System you will read about next, and the system is being considered as an integrated solution on new and upgraded aircraft.

Figure 7. At the Innovation Expo the month following Bill's death an innovation booth was set up to honor Bill's efforts, and Coast Guard senior leaders publicly recognized his innovative spirit and contributions at the closing ceremony.

D. AIRBORNE DATA COMMUNICATIONS SYSTEM

During the development of MISLE Lite and the moving mapping application, Air Station Cape Cod recognized that a real time data link to share aircraft position and vessel sightings would be ideal. At the 2002 Innovation Expo, we learned from Pete Batcheller of Booz Allen about an Iridium satellite solution that would meet our needs. Over the course of the year, he educated Air Station Cape Cod about how DoD had employed the system with secure connections to their information networks at minimal cost, and showed us how we could leverage the same solution in the Coast Guard.

Despite the strong desire to implement the Iridium satellite solution, everyone on the MADD team recognized it would take too much time and effort for a field unit to accomplish. During the fall of 2003, Coast Guard headquarters adopted the National Graduate School program, and ten teams were formed to work on process improvements. One of the teams agreed to build on the work the MADD NGS graduate team had done by adding the airborne data link capability. They formed the Airborne Data Communications System (ADCS) team and were provided the MISLE Lite application with the FalconView interface as well as all of Air Station Cape Cod's research and contact information regarding the Iridium solution.

Over the course of their one-year program the ADCS team gained senior leadership support for the initiative, operationally tested the Iridium solution onboard a Coast Guard helicopter, and documented the process improvements estimated to be worth $147 million per year.[93] During their graduation, they presented the results of their project to Congressman Delahunt and Admiral Allen, then serving as Chief of Staff of the Coast Guard. Based on the research and benefits the team had identified, they were provided $4 million to equip all Coast Guard aircraft with the solution.

After graduating, two members of the ADCS team, CDR Bob Feigenblatt and LCDR Dan Mades, continued to work on the initiative. Part of the $250,000 innovation grant provided for CG-MPS was used by Georgia Tech to lay the groundwork for the ADCS user interface in FalconView while the team worked through formal government contracting requirements. When contracting for the project ran into difficulties and delays, Bill Imle helped by leveraging contacts from his PFPS innovation network to identify a pre-existing Navy contract that could be used to perform the work. In 2007, after LCDR Mades retired and CDR Feigenblatt transferred from his position, I used my OPC position to help provide some continuity by working with the new program manager to share a historical perspective and provide rationale behind some of the project

[93] The National Graduate School, http://www.ngs.edu/cg_sponsored/MaritimeDomainAwarenessImprovements(MDA).html (accessed January 20, 2008).

requirements and previous decisions made. As a result, he was able to make informed decisions that leveraged previous innovation work and funding to deliver a successful solution for Coast Guard Aviation.[94]

[94] Work on the first prototype C-130 is being completed as this paper is written. As a result of the substantial amount of previous work done on the solution, risk of failure is considered low.

VI. ANALYSIS OF THE COAST GUARD INNOVATION PROJECTS

> And it ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new.
>
> Nicolo Machiavelli

The Coast Guard innovation projects highlighted in the case study benefited from a number of supporting elements grounded in both science and art. The critical success factors discussed in the literature review are presented in Table 1 to help explain the impact of each factor on the four innovation projects. A scale of one to five, with one being highest, is used to convey the level of importance of each factor for each of the innovations. Each factor will be discussed in further detail after the table.

Critical Success Factors	MISLE Lite	Tablet Computers	CG Mission Planning System	Airborne Data Communications
Leadership				
Catalyst - Integrators	1	1	1	1
Catalyst - Accelerators	1	1	1	1
Activist - Miners	1	1	1	1
Activist - Explorers	1	1	1	1
Strategy	3	3	1	1
Collaboration	1	1	1	1
Building Blocks				
Systems Approach	1	2	1	1
Use of new IT	1	1	1	1
Process Improvement	1	1	1	1
Private/Voluntary Involvement	2	2	3	1
Empowerment	1	1	1	1
Enablers				
Senior Support	1	3	3	1
Rewards/Recognition	1	5	5	1
Resources	1	1	1	1
Diversity of Backgrounds	1	5	2	5
Benchmarking	1	1	1	1
Ideas from all levels	1	5	1	5
Experimentation	1	1	1	1

Table 1. Weighted analysis of critical success factors for case study innovation projects.

A. CATALYSTS AND ACTIVISTS

Based on my research and aided by closely observing the emergence of the four innovations over the past seven years, I believe at its core the story behind the Coast Guard's successful innovations is one about the people that Dr. Neal Thornberry terms "Integrators, Accelerators, Miners, and Explorers."[95] As noted above, the Coast Guard's loosely structured innovation program played an instrumental role in developing successful innovations; however, it is not a program that can simply be bottled and implemented at other organizations that desire more innovation.

The innovations in the case study succeeded through the dynamics created between activists and catalysts. Leaders with integrity at all levels of the Coast Guard were provided the freedom to pursue the organization's needs to the maximum extent their positions allowed. The innovations benefited directly from activists driving individual initiatives in a supportive culture of innovation created by catalysts. This analysis will focus on the roles of integrator, accelerator, miner, and explorer played by all levels of leaders within the Coast Guard. Some played multiple roles and were mentioned directly in the case study; others played less visible roles that will be highlighted here. Ultimately, the innovations involved hundreds of people working in concert to drive their success. While it is not possible here to highlight every contribution, we understand that each success was only accomplished largely by collaborations among invisible groups created by the activists and by the catalysts that energized the projects. Catalysts and activists all received top weighting in each of the projects because of their critical importance in creating the right environment and making the decisions that ultimately led to each project's success.

1. Integrators

Leadership and vision are recurrent themes in nearly all the research on change management and innovation. The Coast Guard innovations demonstrate the importance of leadership and vision at multiple levels in the organization. In his paper "Leading

[95] Thornberry, *Lead like an Entrepreneur.*

Change from the Middle," Geoff Abbott points out that leaders exist at all levels. Whether a leader is considered junior or senior, Abbott notes that depending on the frame of reference, every leader can be considered "in the middle." As an example, he shows how even admirals, the most senior leaders in the Coast Guard, have many people above them in the Executive Branch and Congress to whom they must answer.

Abbott was what Neal Thornberry would classify as an "integrator." He worked directly for the Chief of Staff of the Coast Guard and had a broad range of responsibilities. In his role as chairman of the Innovation Council, Abbott used his broad responsibilities to help build a supportive enterprise-wide innovation program with multiple complementary elements. Much of the Coast Guard's modern innovation program detailed in the case study was implemented under his watch.

As one of many captains at Coast Guard's headquarters between 2001 and 2006, Abbott demonstrated courageous leadership from the middle after attending the graduation of the first Coast Guard National Graduate school program. Abbott advocated for national implementation of the program and used all of his position and personal power to champion the initiative. He successfully argued for the use of innovation-funded scholarships in conjunction with the Coast Guard's traditional tuition assistance program to reduce the cost of the masters program to $2,800. When Coast Guardsmen responded in massive numbers, there was not enough tuition assistance funding to support the demand. Abbott insisted that funds be found elsewhere and enlisted support from the Coast Guard's Chief of Staff, Admiral Allen, to successfully gain additional funds.

Geoff Abbott's background as commanding officer of a highly innovative Civil Engineering Unit in Providence, Rhode Island, and later as commanding officer of the Coast Guard's Research and Development Center also made him an excellent "accelerator." While at those units, he provided a safe environment for his people to innovate by spurring them on and protecting them from negative repercussions. After advancing to his position at Coast Guard headquarters, Abbott complemented his role as

"integrator" by also serving as an "accelerator." He became personally involved in each of the four innovation projects highlighted by serving as both a champion and protector for the innovators involved in each initiative.

In the aftermath of Hurricane Katrina, Abbott, still recovering from open heart surgery, risked his health and reputation by leading a small team of innovators down to New Orleans to demonstrate the capabilities of CG-MPS. As the case study demonstrates, that opportunity played a crucial role in operationally demonstrating the benefits of CG-MPS. It provided innovators follow-on briefing opportunities with senior leaders; helped secure the additional $250,000 innovation grant to add capabilities to CG-MPS; and helped make it a formal enterprise-wide application.

Another invisible "integrator" is Fred Hooghouse, one of the two dedicated headquarters managers of the innovation program. After retiring from a successful consulting career, Fred accepted a government service position responsible for organizing the Innovation Expos each year, tracking innovation projects, and guiding the innovation council. Fred has played a critical role in the overall innovation program's success. As military officers have transferred in and out, Fred has provided continuity and historical perspective to help ensure the program's success. His method for tracking innovation projects strikes the delicate balance between accountability and providing freedom needed for the innovations to emerge.

2. Accelerators

The innovation projects benefited from multiple accelerators striated through multiple levels of the Coast Guard. The operations officers at Air Station Cape Cod and Air Station San Francisco, CDR Santucci and CDR Imle, were both critical accelerators for the first three innovations discussed. CDR Santucci allowed 25% of his aviators to enter a masters program despite the increased operations required to address security requirements in the post-9/11 environment. He also provided his people the opportunities necessary to demonstrate their innovations. Despite being the most junior aircraft commander at Air Station Cape Cod, CDR Santucci assigned me to the high visibility Washington, D.C. mapping mission that he knew would include flying the commandant

of the Coast Guard. As he knew it would, that opportunity allowed me to demonstrate results of our innovative work to the commandant. Prior to transferring from the unit, CDR Santucci let me know his replacement might not be as supportive of our efforts. He said what we were doing was good and told me not to ask permission to do things, but instead drive it as hard and as far as I could before being stopped. That advice empowered me then and has guided many of my decisions since.

While CDR Bill Imle was alive, I did not have the pleasure to know him as an accelerator; I only really got to know him once he had retired and became an explorer. The night before his funeral, I joined a group of junior officers who had served under him at Air Station San Francisco. I listened as they recounted story after story of him spurring them to be innovative and to improve their operations. As an outward sign of their innovation, he asked one of his pilots to create a "skunk works" patch for the unit. As each of the pilots told their stories, it was clear CDR Imle had been a great "accelerator" and that it was no coincidence that PFPS emerged from his air station.

In my role as a Boston-based OPC, I had the benefit of serving under three successive accelerators, CDR Bob McKenna, CAPT Dan Ronan, and Mr. Mark McCabe. Each provided the senior protection and freedom to travel as needed to support the development and implementation of MISLE Lite and CG-MPS. Over the three years required to implement the applications as an Organizational Performance Consultant, many could not see the invisible role my billet played in fostering collaboration and facilitating forward progress. Each supervisor shielded me from much of the criticism and allowed me to continue supporting the efforts despite having significant immediate demands for which they could have employed me.

Largely because of NGS and the Innovation Expos, many Coast Guard admirals also became accelerators for the innovations highlighted. The Coast Guard's Vice Commandant, Vice Admiral Crea, served as one of these accelerators as the Coast Guard's First District Commander and later as the Atlantic Area Commander. As the NGS MADD team's senior champion, Vice Admiral Crea signed a formal document of support for the team's efforts. To demonstrate further support, she attended the team's graduation as well as the Innovation Expo where the team presented their work. Her

high-visibility support for the effort played a critical role in helping transition the innovations at Air Station Cape Cod into enterprise solutions. Implicitly her efforts helped hold unsupportive officers at bay because they did not want to be seen as openly opposing something she supported. Explicitly she worked to protect innovators under her command and used her position and authority to help move efforts forward.

Rear Admiral Pekoske, the Coast Guard's Chief of Operations, also served as a senior champion for NGS teams, and actively worked to support the innovations in the case study. As the reader will remember from the case study, as a captain he flew with the commandant on the flight around the Washington, D.C. area using an early version of the innovations that were ultimately fielded. By the summer of 2004, he had been promoted to Rear Admiral and replaced Vice Admiral Crea as First District Commander. In the fall of 2005, he saw a significantly improved version of the MISLE Lite and FalconView innovations in operation onboard the Coast Guard Cutter SENECA. After returning from the trip, he said he wanted to see the solution deployed on all his cutters, and included it as part of the District's strategic plan.

3. Miners

Lieutenant Commander Lillian Maizer, the Boston-based OPC who founded the National Graduate School, was a classic "miner." She strongly supported the Coast Guard's quality program that is modeled on the Baldridge National Quality program. The program emphasizes continuous improvement principles and the importance of systematic and repeatable processes. LCDR Maizer recognized that she could not adequately actively support her region on her own, which covered all Coast Guard units in the Northeast, and implemented the NGS program as a way to teach the Baldridge principles while also improving internal Coast Guard processes. As a result of her leadership, 450 Coast Guard personnel formed more than 100 NGS process improvement teams which have delivered process improvements valued at more than $300 million by the Coast Guard since 2003.[96] All four innovations highlighted emerged from the work initially started by the MADD and ADCS NGS teams. With allowance for up to 100 new

[96] The National Graduate School, http://www.ngs.edu/cg_sponsored/index.html (January 21, 2008).

Coast Guard personnel to enroll in the NGS program annually, the systematic and repeatable process LCDR Maizer delivered continues to generate value for the Coast Guard despite the fact she is no longer with the organization.

Pete Goershel was a hidden "miner" within the Coast Guard. Pete is a retired Chief Electronics Technician who now serves as a civilian computer administrator for the Coast Guard. During the initial phase of the Air Station Cape Cod's project, he provided support by ensuring that the Toughbooks had virus protection, and by choosing not to investigate the innovator's brief connections to the Coast Guard data network for MISLE Lite data transfers. When Pete saw that the bureaucracy was going to take more than two years to approve the solution formally, he helped implement an alternative that enabled the solution to operate securely while the formal approval process proceeded. Despite being an invisible computer support representative, Pete's courageous leadership allowed Air Station Cape Cod to conduct their homeland security missions more efficiently and effectively three years sooner than the headquarters formal policy allowed. More importantly, Pete provided the air station innovators enough latitude and time to generate the short-term wins necessary to gain additional support for formal approval and national implementation.

4. Explorers

Bob DeYoung, the lead OSC Martinsburg, West Virginia programmer for the BO JPA project and the Air Station Cape Cod Vessel Sighting application, fits the explorer role very well. As a former lineman on the Coast Guard Academy's football team twenty-five years ago, Bob's persona seems more in line with a football player than a programmer. He can be both stubborn and persistent in pursuing what he believes is right and does not mind taking some abuse to prove that he is right. During the initial development of MISLE Lite, Bob persisted in developing it despite repeated efforts to get his team to stop. He was told that his team was "serving as a back door to give the field what they wanted out of MISLE," a remark he took as a compliment.[97]

[97] DeYoung, interview.

As you will recall from the case study, Bob's team was ultimately disbanded and individually assigned to support other projects. Unfazed, Bob took the lessons learned from working on MISLE Lite and built a similar application for command centers using Google Earth. He won an innovation award at the 2005 Innovation Expo for his effort but ironically, that same innovation was one of the reasons given for terminating him in December of 2006.

One of the Coast Guard's larger cutters, the 270' CGC SENECA had installed the solution in their Combat Information Center. During a port call in Washington, D.C., they proudly displayed how Bob's Google Earth solution improved their operations during a tour given to senior officers and congressional staffers. The tour generated a congressional inquiry to find out why operational Coast Guard units were using a "free" Google Earth solution to support their mission rather than formally-funded systems provided by the Coast Guard's Command and Control Center.

As a more than $50 million-a- year operation responsible for command and control, the Coast Guard's C2 Center was a "sacred cow" that Bob had threatened and angered by fielding a competing application. Bob's Google Earth application was immediately turned off and he was fired shortly afterward.[98] Fortunately, some of the capabilities from his effort were transitioned into MISLE's own mapping system and are used daily throughout the Coast Guard. The same traits that made Bob a great "explorer" also made him a difficult employee for a bureaucracy to control and ultimately led to his dismissal. As one might imagine, he is thriving in his new position with a smaller, more entrepreneurial company.

Bill Imle, the CDR who initially sent a letter to all Coast Guard aviation units advocating the use of the PFPS in 2002, was initially only an "accelerator" who supported the innovative environment at USCG Air Station San Francisco that allowed PFPS to emerge.[99] After retiring, he eventually became an "explorer" in his own right. After twenty-four years flying helicopters for the Marines and Coast Guard, "explorer"

[98] Bob now works for Ravenwing, and other than the commute he reports he is much happier in his new position.

[99] The PFPS name was changed to CG-MPS in 2006.

skills did not come naturally to Bill. Though he was very charismatic and charming, Bill was not a salesmen, and he was inclined to follow organizational processes and procedures. He honestly could not understand why the rest of Coast Guard aviation had not adopted PFPS after reading his letter discussing the benefits of the application in 2002.

After retiring in 2005, Bill moved his family from San Francisco to Mobile, Alabama to accept a position funded to train aviators how to use CG-MPS. After purchasing a home and getting his family situated where he hoped to enjoy his retirement years, he learned that the money used to hire him would run out at the end of the fiscal year, and follow-on funds had not been identified. Realizing he would be either out of work or have to move within a matter of months, Bill realized he needed to help others understand the benefits of the system. He worked tirelessly to build the Coast Guard's training program, gain additional funding, address the many technical issues associated with its implementation, and to demonstrate the benefits of the system operationally.

After Hurricane Katrina hit the Gulf Coast, Bill immediately began using the system to aid mission planning and situational awareness. Despite being retired and having no formal authority, he convinced others to ship additional mission planning systems and to deploy in support of him. His initial effort led Captain Geoff Abbott to join the effort with additional mission planning systems and together they deployed the systems to Louisiana and later to Texas in support of Hurricane Rita response efforts. Bill's efforts in support of both hurricanes helped decision makers see the benefit of CG-MPS and helped expedite its approval as a formal Coast Guard system.

B. STRATEGY

Initially, the innovations exhibited little long-term strategy. In the aftermath of 9/11, the focus of the leaders involved with the projects was on short-term tactical accomplishments. The development of the vessel sighting and tablet computer innovations was highly reactionary to the evolving environment. The innovations began as PDA applications, transitioned to "web pads," and ultimately ended up in a tablet PC

version with completely different operating systems in under a year. When they began, none of the leaders involved with the innovations could have planned for or predicted the final solution implemented.

After the first year's development resulted in a tangible solution incorporating MISLE Lite, tablet PCs, and CG-MPS, strategic planning to grow and expand the solution became significantly more important. The Coast Guard Innovation Council became more involved with the projects and helped develop a strategy to transition the Air Station Cape Cod innovations to the remainder of the Coast Guard. Part of that strategy included providing $150,000 to Coast Guard aviation to adopt the solution. The Innovation Council also expanded NGS classes to headquarters, which led to the development of the ADCS innovation. Another part of their long-term strategy involved moving me into an Organizational Performance Consultant position where I could continue to support and guide the innovations.

As an OPC, I had the benefit of reading detailed descriptions of all Coast Guard systemic issues and best practices. I was also able to facilitate senior leaders through their strategic planning sessions and gain a thorough understanding of their strategic intent. This broader perspective helped me understand how the tactical solutions, first built at Air Station Cape Cod, could help achieve grand strategic objectives such as improved Maritime Domain Awareness. That understanding led to deployment of MISLE Lite on Coast Guard cutters and helped direct all future efforts on the innovations. The $250,000 of innovation funding provided after Hurricane Katrina was strategically spent to improve interoperability and position CG-MPS as an application of choice for homeland security agencies. A small portion of those funds were used to build part of the ADCS solution while that solution was going through a protracted contracting process. Once their contract was authorized, the work already completed toward implementing their solution ensured more funds were added to completely integrate ADCS with CG-MPS and MISLE Lite.

C. COLLABORATION

Collaboration is weighted highest for each innovation because it was a critical element in the development and linkage of each solution. It is impossible to identify one person or group responsible for each innovation. To illustrate the point, MISLE Lite began as a PDA application built to provide a checklist for Coast Guard Boarding Officers and as a tool to record boarding information. Within a year of being adapted for aviation's use, it had been transformed into a tool that plotted a common operating picture, provided automatic information alerts, and had reduced data entry time from ten minutes to ten seconds for each sighting. Within three years, the solution had been expanded to Coast Guard cutter operations. Now, six years later, many of the MISLE Lite capabilities have been incorporated back into the PDA application and are being expanding to other Coast Guard operations in a new version called MISLE Mobile. Direct collaboration among field operators and programmers created the genius that developed the application; neither group could have succeeded without collaboration.

D. BUILDING BLOCKS

1. Systems Approach and Process Improvement

The most significant building block common to all four innovations highlighted was the National Graduate School program. NGS's Master of Science in Quality Systems Management degree program teaches a systems approach to process improvement and quality. All students learn Malcom Baldridge's quality principles, and they are required to use W. Edwards Deming's "Plan-Do-Check-Act" or the Six Sigma "DMAIC" process improvement methodologies as they work on their Master's business projects.[100] NGS's approach complements the Coast Guard's overall management framework, which is based on the Malcom Baldridge National Quality Program.

[100] DMAIC stands for Define, Measure, Analyze, Implement, and Control from GE's DMAIC approach.

2. Use of New Information Technology

Each of the innovations relied heavily on new information technology systems. During the late 1990s, the Coast Guard embraced the "e-Coast Guard" concept, which relies heavily on web based information systems and computing technology. By 2002, new information technology systems were deployed for Coast Guard personnel to use at their desks, but few systems had been extended and optimized to support personnel in the operational environment. Each of the four innovations helped extend information technology into the harsh Coast Guard operational environment and in doing so, dramatically improved mission efficiency and effectiveness.

3. Private/Voluntary Involvement

Each of the innovations benefited significantly from voluntary private sector involvement. Teletype GPS of Boston, Massachusetts volunteered a significant amount of time and effort to improve the Air Station Cape Cod moving map solution. Michael Krouse, a Panasonic salesman and former Marine, provided significant assistance to the initial effort by bringing Panasonic engineers to Air Station Cape Cod to help optimize the Toughbook solution. He also used his extensive network of private industry and government contacts to support the innovation effort through multiple avenues. Pete Batcheller, a Booz Allen Hamilton engineer and retired Navy Commander, devoted considerable energy toward educating the Coast Guard on information technology solutions being employed by DoD in Afghanistan at the time. His involvement led to improvements in the MISLE Lite application and also provided the blueprint for the Airborne Data Communications System.

4. Empowerment

The Coast Guard captures its ethos and guiding principles in U.S. Coast Guard Publication 1. It was written to provide "unity of purpose, guide professional judgment and enable Coast Guard men and women to best fulfill their responsibilities."[101] It is a

[101] United States Coast Guard, http://www.uscg.mil/top/about/doc/Quotes_Foreword_Intro.pdf (accessed January 21, 2008).

remarkable document that begins with quotes from Coast Guard leaders over the past two centuries like Captain John Faunce's, "It had the right effect," in reference to his cutter *Harriet Lane* firing the first shot of the Civil War in Charleston, South Carolina. It relates to Coast Guardsmen an understanding of their history, one richly filled with courageous leaders and actions, and provides them with guiding principles. One, the Principle of "On Scene Initiative," empowers all Coast Guardsmen to use their best judgment in carrying out their missions. The excerpt below is from the last paragraph of that principle:

> Good decisions are made in unpredictable situations when Coast Guard personnel on the scene of an emergency or a crisis are rigorously trained to act as part of a cohesive, cooperative team. It works through the common understanding of how individual incidents or situations are normally handled. This shared understanding lies at the heart of effective decentralized command and control.[102]

Additional principles of unity of effort, flexibility, managed risk, and restraint are also conveyed to help provide Coast Guardsmen a foundation of principles on which to base their decisions. "Trained initiative" is a fundamental term in the Coast Guard's vernacular. It is first taught during Coast Guard entrance training programs and is constantly reinforced through daily Coast Guard operations. Coast Guardsmen are free to deviate as needed to accomplish their mission objectives. They accept accountability for their decisions and, based on more than two hundred years of tradition, know that those decisions will be supported after the fact as long as they were made within the service's guiding principles.

The case study innovations benefited from two NGS teams formally empowered by senior leadership to work on specific process improvements; however, they also significantly benefited from many other highly-empowered personnel. The catalysts and activists mentioned above were all empowered to make decisions that helped achieve

[102] United States Coast Guard, http://www.uscg.mil/top/about/doc/Chapter_Four.pdf (accessed January 21, 2008).

success. They also created the necessary environment to empower others like procurement and computer support personnel to make critical decisions needed for successful implementation.

E. ENABLERS

1. Senior Support

Without sustained senior support for the quality and innovation programs, none of the innovations highlighted would have been initiated, much less advanced. As the case study demonstrated, senior leadership committed significant resources over a prolonged period to create a supportive environment for innovation and process improvement. In addition to the $9.5 million committed directly to support the innovation program, senior leaders also ensured twenty-four OPC positions were created (and protected) to support innovation and the Baldridge systematic approach to quality. In addition to the four innovations studied here, senior leaders specifically empowered NGS teams to implement more than one hundred additional process improvement projects. When needed, senior leaders personally involved themselves to move innovations forward or provide protection and recognition for innovators.

2. Rewards/Recognition

The innovations highlighted generated three national innovation awards and led to recognition by Government Computing News for visionary IT leadership.[103] The ADCS team provided the keynote presentation during their graduation, where they were able to brief Congressman Delahunt and the Vice Commandant of the Coast Guard. The rewards and recognition provided innovators energy to continue their efforts, but more importantly, they served to let others know that the work was valued by Coast Guard senior leaders. This value recognition helped restrain unsupportive forces and allowed forward progress on the innovations to continue.

[103] Government Computer News, http://www.gcn.com/print/26_10/44231-1.html (accessed February 19, 2008).

3. Resources

The Borins report listed resources as the most significant barrier to innovation within government. The Coast Guard's innovation program overcame this barrier through both direct and indirect support of the four documented innovations. The innovation program provided over $1 million in direct funding to support the innovations. It also provided an additional $400,000 in funding to support the NGS program and $2 million to support Innovation Expos, both of which were instrumental to the successful innovations. In addition to the monetary resources, the innovation program also benefited significantly from the personnel devoted to supporting the program. The twenty-four OPCs responsible for process improvement and innovation were instrumental in fostering a favorable environment for innovation to occur, and in directly supporting specific innovations when required. As a result of the innovation program's efforts more than $5 million in funding from other programs was provided to support and sustain the innovations.

4. Diversity of Backgrounds

MISLE Lite powerfully demonstrates innovation that can emerge from collaboration among people of diverse backgrounds. What began as a PDA application to help Coast Guard Boarding Officers was quickly transformed through the interaction of multiple communities. The team that developed MISLE Lite actively solicited ideas and criticism from everyone they interacted with. Information exchanges between programmers, contractors, junior operational personnel, aviators, and Boarding Officers created the group genius that led to the rapid development of MISLE Lite's capabilities.

The Portable Flight Planning System (PFPS), which serves as the basis for CG-MPS, was developed in much the same manner. It originally started as a mission planning system for F-16 pilots, but was quickly adopted by surface units for their needs as well. There are now more than 20,000 personnel throughout the world using and growing and adapting PFPS applications for their needs. This diversity of backgrounds has created a remarkably powerful application at a fraction of the cost that a-top down developed application would have required.

5. Benchmarking

Benchmarking was responsible for much of the success of the projects. The National Graduate School program required both the MADD and ADCS teams to benchmark their projects early in their process improvement cycle. Pete Batcheller shared how U.S. forces were using PDA job aids and Iridium data links to execute their missions in Afghanistan. Many of those capabilities were incorporated into the MISLE Lite application and the ADCS iridium data link solution. To support their decision to use ruggedized tablets, Air Station Cape Cod benchmarked DoD forces that used both ruggedized and non-ruggedized computers in harsh environments. They found that the use of Toughbooks ensured higher mission reliability and also saw that processes were in place to immediately fix damaged Toughbooks and return them to service. Based on their benchmarking, they found that buying ruggedized computers was actually cheaper in the long term than purchasing non-rugged computers once reliability was factored in.

6. Ideas from All Levels

Both MISLE Lite and CG-MPS benefited from user feedback at all levels. The developmental philosophy behind both applications was very similar. Programmers listened to the people actually using the systems and incorporated their feedback into the applications. During the initial development of MISLE Lite, 156 versions were developed based on daily feedback from aircrews. Ultimately, the programmers were successful in creating an application that was easier for the aircrew to use than writing on a sheet of paper. That same development process was used to expand MISLE Lite to surface operations, and continues to lead to the development of new versions based on feedback from new user communities.

7. Experimentation

The Coast Guard's Innovation Council helped provide some strategic direction, "Commanders Intent," by making decisions about which projects to support and providing general guidance for innovators. Between 2003 and 2007, the Innovation Council funded thirty projects. Once a decision was made to fund an innovation project,

the Innovation Council transferred the funds to innovators and trusted the money would be spent appropriately. The Council did not require program reviews or metrics, and deadlines were not established. As we saw with each of the innovations described in the case study, this freedom allowed innovations the time and flexibility to develop based on the patterns that emerged. Projects that failed to be broadly implemented were not viewed as failures, but instead were valued for the feedback they provided to the Coast Guard.

F. MOTIVATION

Though not explicitly identified in the literature review, energy and persistence generated from motivation was an overall critical factor in the achievement of the innovation projects. Energy was needed to fuel collaborations; it was needed to think creatively; it was needed to drive change; and it was needed to survive the lengthy bureaucratic process required to transition the innovations into enterprise-wide solutions. Innovation is inefficient and often evolves over prolonged time periods. As we saw with each innovation, they required years of passionate and persistent pursuit by a number of teams and individuals. The innovation process is not a neat, clean affair. Accompanying the joy and reward of creating value and improving the organization was a substantial amount of stress, frustration, anger, and other draining emotions that had to be overcome. Some of the innovators involved in the process lost their jobs or damaged their careers, some lost friendships, and some experienced health problems as a result of the workload. Ultimately, success required a phenomenal amount of energy.

Overall, the development of MISLE Lite required four years of significant energy. Implementation of the CF-18 tablet computers required four years of patience and persistence before they were adopted by the enterprise. CG-MPS required five years of effort to implement and transition it from an innovation to a formal Coast Guard application. And six years will have elapsed since the idea for ADCS was first presented to the Coast Guard at the 2002 Innovation Expo and when the first formally installed prototype is flown aboard a Coast Guard C-130 aircraft in the spring of 2008.

The innovation program provided a supportive environment where innovations could remain viable long enough to develop into mainstream programs, but each innovation's success ultimately depended on the long-term perseverance and persistence from innovators with the energy and passion to see it succeed. The terrorist attacks on September 11, 2001 created a substantial pool of energy that initially fueled the launch of the projects and advanced them. As a key initial driver of the projects at Air Station Cape Cod, I can say unequivocally that without 9/11 as catalyst, we would not have had enough energy or been willing to take enough risk to successfully advance our innovations beyond the local unit level.

The energy created by 9/11 would not have been enough on its own to sustain the long-term perseverance that was required. Gradually the relationship energy formed among collaborators began to serve as the prime motivator. Members involved in the innovation process were never ordered to advance the projects or stay with them years after they graduated and received recognition for their work. They had individual passion and desire to advance the projects, but the trust and dedication to other members of the collaborative team significantly boosted that individual energy. Many continued to work on the projects despite negative consequences, simply for the joy of working together to advance the cause.

A month before Bill Imle died, I told him my supervisor was growing impatient with the amount of time I was spending supporting CG-MPS and had asked when he was going to get me back from the project. With a huge belly laugh Bill asked, "Did you tell him never?!" In many cases, the bonds formed between team members superseded traditional organizational bonds and even the immediate innovation. In Bill's case, I can say the two years I spent with him advancing CG-MPS were the most rewarding of my career. They were extremely challenging years for both of us, but we enjoyed the camaraderie and the challenge of moving the system forward. Once he was gone, the joy of advancing CG-MPS also largely disappeared.

VII. CONCLUSIONS AND RECOMMENDATIONS FOR INNOVATION IN THE DEPARTMENT OF HOMELAND SECURITY

Effective innovation needs purpose, direction, and coordination from senior leadership. The innovations highlighted by the case study were focused on improving situational awareness and communications for Coast Guard aircraft. The work was accomplished in a post-9/11 environment where Maritime Domain Awareness, communications, and interoperability became operational requirements thrust to the forefront. Frontline aviation personnel at Air Station Cape Cod knew where the gaps were in their processes and were motivated to fix them. Besides being highly focused and motivated to succeed, they were also able to sustain a highly coordinated effort on multiple fronts by enlisting the support of senior leadership, OSC programmers, the ADCS NGS team, multiple headquarters program offices, and outside contractors.

The creativity and collaboration that led to the development of the innovations occurred during a period of intense activity in the two years spanning 2002 and 2004. Within the first year, the BO JPA application had been transformed from a simple PDA-based data capture form into a system that had a searchable database capable of automatically filling out forms, fusing information from GPS, displaying Common Operating Picture information into an aircrew's moving map, and automatically providing information alerts about higher risk vessels. In that same year, the innovators quickly went from small PDAs, to "web-pads," to a non-rugged tablet computer before settling on Panasonic Toughbook tablets as the best form factor. They also helped identify the wireless solution needed to provide near-real time, machine–to-machine communications with all Coast Guard aircraft. All of that work was supported using only a $75,000 innovation grant and by leveraging resources from other programs. By the fall of 2004, the ADCS team completed the innovation work by integrating the Iridium data-linking capability into the solution.

Despite all of the positive supporting factors of the Coast Guard's innovation program, it had one significant deficiency during the initial years of the program; it was not coordinated with the rest of the Coast Guard. That lack of coordination caused unnecessary disagreement, misunderstanding, anger, and frustration between innovators and mainstream programs. The gap between innovation emergence and implementation throughout the enterprise – an average of four years – significantly diminished the value of the innovation program.

The innovation program helped identify the CF-18 tablet computer's benefits for the aviation community as soon as they went into production, but four years elapsed before they were formally approved to connect to the Coast Guard's data network. At that point the CF-18 was no longer an innovation; it had emerged as a mainstream computer which program managers could easily gauge the benefits because of the widespread use by other organizations. Waiting to ensure the CF-18 was a proven commodity was a safe approach for the Coast Guard, but it was an approach in direct conflict with its stated desire to be innovative.

Using an innovation program to identify new computers, new software, and new processes is largely futile without also having processes in place to transition those innovations quickly into mainstream use. Implementing the highlighted innovations was much slower, difficult, and painful than it needed to be because the innovation program failed to address transfer issues between innovation and bureaucracy adequately from the beginning. The program has increased its attention to addressing this issue, but it still needs significant improvement.

Without a department or agency's commitment to capitalize on innovation in a coordinated fashion, an innovation program lacks maximum effectiveness. Despite the success of the four highlighted projects, and many others, the Coast Guard's innovation budget has steadily decreased from $4 million to $1.5 million. Overall, the program lacks sufficient human capital resources to effectively coordinate and sustain high impact innovations in a systematic and repeatable manner. If the Coast Guard decides to continue a formal innovation program, it must engage its OPC corps more fully in facilitating the innovation process by coordinating NGS teams, headquarters, and

resources to achieve the strategic intent of senior leadership. Without approaching innovation in such a coordinated fashion, the success of the Coast Guard's program will continue to depend too largely on personal heroics and sacrifices of its dedicated personnel. While the caliber of Coast Guard men and women will continue to generate successful innovations regardless of the processes in place, sub-optimal processes will unnecessarily lead to termination or burnout of those individuals, too often stripping the Coast Guard of its most innovative people in the process.

The Department of Homeland Security provides considerable support for innovation within its Science and Technology Directorate, in industry, and at universities, but has not devoted an equivalent effort to support internal innovation within the department. The first question to answer is whether a widespread innovation program is worth the cost and effort. When I began this research, I had only looked at the benefits of the Coast Guard's innovation program, not the costs. While conducting my research I met with Rolf Dietrich, DHS S&T Deputy Director for Innovation, and his Technical Director, Stephen Dennis. During the meeting, I outlined some ideas and recommendations for establishing a DHS innovation program along much the same lines of the Coast Guard's program. Mr. Dietrich said it "sounded" great, but asked what the cost of time, money and energy would be compared to the benefits gained.

The remark caused me to look at our own innovation program from a different perspective. Dr. Neal Thornberry reinforced Mr. Dietrich's cautious approach to my initial recommendations when I interviewed him and read his book *Lead Like an Entrepreneur*. In his work with hundreds of organizations attempting to be more innovative and entrepreneurial, Dr. Thornberry found that organizations that said they wanted innovation were often unprepared when their innovation programs began delivering innovation. When innovation was not embedded in the rest of the organization's culture, systems, and processes, negative outcomes inevitably arose. Dr. Thornberry argues that an organization should either wholeheartedly embrace innovation as part of its business process and culture, or not do it at all. Having personally lived

through the Coast Guard's dual personality of embracing innovation on one hand and hating it on the other, I echo Dr. Thornberry's warning that it is not worth having an innovation program without having it integrated into the overall organizational construct.

By studying, observing, experiencing and by comparing and contrasting, I conclude that a more widespread internal innovation program has the potential to benefit all DHS agencies and provide greater collaboration between federal, state, and local partners. I also know from that same research that an internal innovation program serving the more than 180,000 DHS employees is not something that can simply be cobbled together by ad-hoc members and grass roots support. For such a program to be effective, it must have senior leadership support and be a part of DHS' overall strategic drive. Absent those factors, the costs would likely outweigh the benefits.

If DHS does choose to pursue an internal innovation program, it already has a good framework in place through Science and Technology's Capstone Integrated Process Teams, Technology Clearinghouse, and its TechSolutions programs. Expanding the focus to include innovations, like the National Graduate School process improvement approach, that are not strictly science- or technology-focused could be handled fairly easily by adding an additional area of focus either within S&T or externally through another directorate.

The research by Dr. Thornberry and others show that a few people with the right skill sets can have far-reaching impact. A team of collaboration agents, similar to the OPCs employed by the Coast Guard, could significantly enhance information sharing and help coordinate activities to nurture innovation favorably between DHS agencies as well as their federal, state, and local partners. The Coast Guard has twenty-four OPCs that are already performing the role to varying degrees. Many other agencies have people filling similar roles, which could be coordinated to better support internal innovation.

DHS should dedicate resources to support its own group of highly mobile, highly empowered collaboration agents. This group could coordinate with similar agents in other agencies to foster grassroots innovation and collaborative efforts that support homeland security missions. Such a group could either be composed of government

service personnel or employees under a federally funded research and development center like MITRE or the Homeland Security Institute. Additional research would need to be conducted to identify which path would be most effective.

DHS should focus on coordinating and sharing the best practices of internal innovation programs such as the Coast Guard's or the Transportation Security Administration's Idea Factory across departments. Creating an Innovation Council with representatives from each agency meeting regularly may serve that role. Supporting additional Innovation Expos and stakeholders conferences where field innovators from various agencies are able to present their ideas and interact with each other is also recommended. As the World Bank's Development Market Place and the Coast Guard's Innovation Expo demonstrate, the ability to gather and share ideas produces significant returns on the time and money invested.

DHS grants and training should expand on the Coast Guard's use of project-based graduate teams to help meet homeland security needs. In addition to providing education and lifelong skills to the students, these teams, acting in a coordinated fashion, have the ability to complement overall DHS efforts with research and projects that deliver tangible results within one- to two-year time frames. Employing these teams to help address operational requirements identified through the TechSolutions program and other forums could provide extra resources needed to resolve the issues. With low-cost programs like NGS, relatively small amounts of money could be used to educate a large number of professionals while they continue to perform their full time homeland security roles and responsibilities.

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